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A Modern Manufacturing Drill Press.

In our issue of December 13th we illustrated and described a small multiple spindle drill press made for use in telephone manufacturing; we now present another multiple spindle machine designed and built by the same company (The Langelier Mfg. Co., of Providence, R. I.) for the Pettee Machine Works, of Newton Upper Falls, Mass. It is used for drilling the flats for their revolving flat cards; the piece being of cast-iron of T-shaped section, 3 feet 6⅛ inches long, 1⅛ inches wide, and ¼ inch thick. Along each edge of the base 81 holes are drilled ½ inch center to center, $\frac{1}{10}$ inch diameter. The 162 holes are all drilled simultaneously and automatically—not much of a drill press for use in a jobbing machine shop, as will readily be apparent, but wonderfully efficient for the purpose for which it was designed.

The spindles are in two rows, and have their upper extremities cranked and driven by wrist plates that are actuated by the three vertical shafts which are driven by bevel gears, as shown, from the horizontal shaft. There are three of these wrist plates and as the holes drilled are small and the speed high (1,200 revolutions), they are accurately counterbalanced.

The work is fed upward by means of cams, one of which is seen at the left side of the machine in the photograph, with a roller resting upon its upper surface, there being a duplicate cam and roller at the other side, as shown in the drawing, Fig. 2.

In place of the usual platen a cylinder is mounted in bearings, as shown, this cylinder having ten longitudinal grooves formed in it for the reception of the pieces to be drilled; the indexing being done automatically, and the operator having nothing to do but to insert the pieces, and move a lever which fastens them in place. They are automatically released and thrown out.

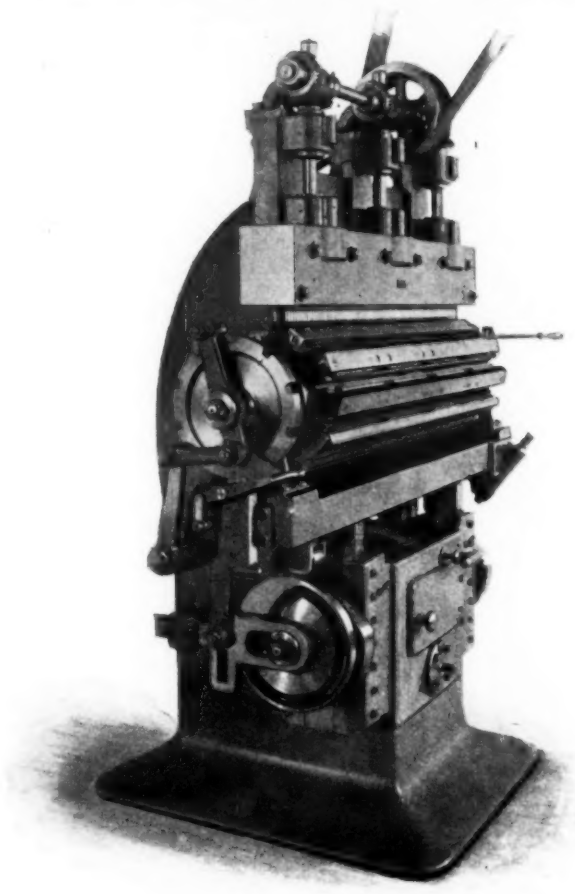
The indexing, etc., is done as follows: At the left of the machine and upon the same shaft with the cams that do the feeding, is a grooved face cam (*F* in the drawings), which revolves in the direction indicated by the arrow, moves the slide *E* forward, and quickly returns it, while the table carrying the cylinder is down, and the drills clear of the work. The motion of the slide *E* is communicated through the lever *D* and link *C* to the rocker arm *B* with its pawl *I*. The locking bolt *G* is forced upward by a spring which rigidly holds the cylinder in position during drilling. It is pushed down by the lower end of the rocker arm *B*, as the pawl *I* is moved towards the front of the machine to engage another notch. The lock bolt being out at this point the pawl *I* pushes the index wheel round, the lock bolt *G* being now forced against the face of the wheel by its spring, slips into the next notch and the rocker arm stops in the position shown in the photograph until another flat is drilled.

The handle *H* is to pull out the lock bolt *G* when it is required to turn the cylinder by hand, but in running the machine continuously it is not used.

The clamping device will be understood from the diagram, Fig. 3 (page 222), showing the wedges, jaws, and clamping bar all in one plane, though in the machine the bar is below to save space. The action is as follows: While a flat is being drilled a new one is placed in the empty groove in front of it, and the clamping bar *B*, Fig. 3, is forced from right to left (as shown by arrow in diagram) by the lever at the extreme right of the machine in photograph, the wedges *W W W W* are forced tightly against the jaws *J J J J*, the motion of the bar being sufficient to compress the springs, so that each wedge (*W*) is tight, even though the flats vary somewhat in width.

The flats are tightly held till they get to the bottom of the cylinder, then the left-hand end of the clamping bar *B* strikes a fixed arm as the cylinder revolves, and is forced to the right, the wedges are pushed back and the flat falls out on the front of the table.

The feed motion is derived from the small pulley seen on the horizontal shaft at the top and by bevel gearing is transmitted to the cam shaft in the base, the knob *K* being connected to a clutch by which the feed is thrown in and out. This shaft can also be rotated by a hand wheel which fits the squared shaft projecting from the front of the base of the machine. Of course, such a machine is not regularly manufactured, but is shown as an interesting example of special machine design. It is a debatable question perhaps whether a



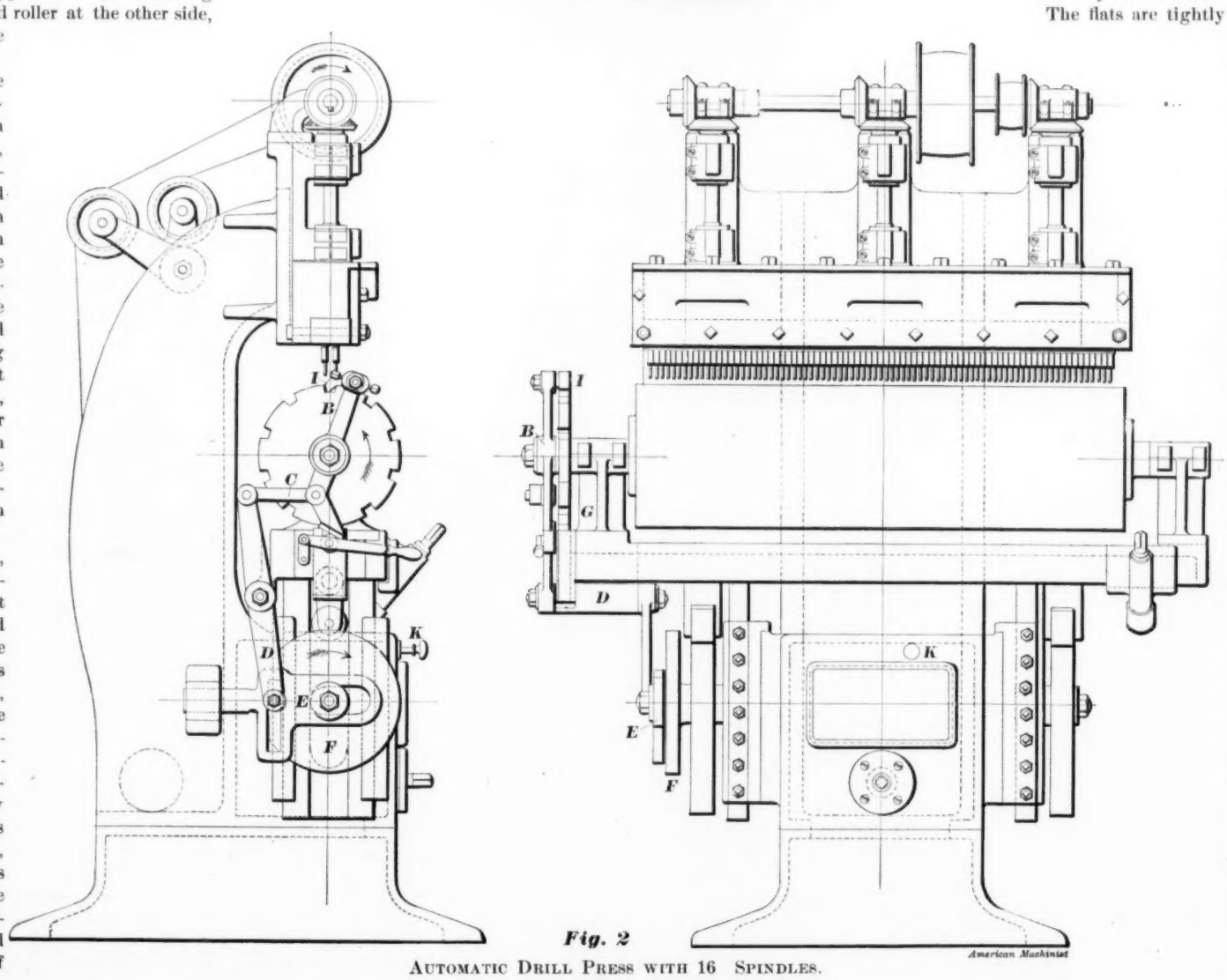


Fig. 2

AUTOMATIC DRILL PRESS WITH 16 SPINDLES.

machine less elaborate in some respects would not have been fully as efficient, but in this case the company for whom it was built wished it to perform the functions described, and were willing to pay for the job.

Heel Core Prints, and Their Core Boxes.

By John M. Richardson.

I do not remember having ever seen an article confined to this subject, but heel cores are so very common, and are used so much where a hole is wanted in a casting coming at some point below the parting line

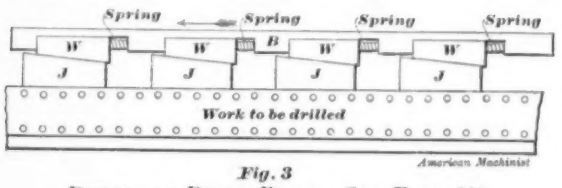


Fig. 3

Detail of Drill Press.—See Page 221.

of the pattern, that I venture to attempt an explanation of the why and wherefore. We will look at a simple example, as shown in Fig. 1, where it becomes necessary to have two round holes cored through the casting in the position shown by the dotted lines, at *E*. It is evident that the core must hang across the mold at that point, and it is quite as evident that it must have something to rest on to keep it in a horizontal position. This difficulty is overcome by putting what is called a heel core print on the pattern, as shown at *C* and *D*, Fig. 1, which leaves a seat in the mold on which to rest the core after the pattern has been removed.

The core print should be made tapering on both sides, and also the *back*. Many patternmakers do not taper them on the back, but I will give what I consider a good and sufficient reason for so doing. Look at Fig. 2, which shows part of the mold with the core set. It will be seen that the round portion of the core must butt up closely to the line *x y*, to have the hole break entirely through when cast.

Now, if the back of the print is straight and the core just to size, it is obvious that the round end of core will be almost certain to scrape the mold from the point *x*, and below it, as it is forced into position, and the result is that the molder will look out for that and file off a little of the end of the core to prevent it, and the hole will not come quite through the casting in a clearly defined circle as it should.

On the other hand, if the back of print is tapered, the core can be the exact length required, and it will not hit the mold on the line *x y* until it reaches the very bottom and is firmly seated.

In the case shown at Fig. 9, it is not necessary to have the back tapered, for here we meet with a new condition. This view also shows the pattern removed and the core set. It will be seen that there was a boss on the pattern which must have been attached loosely with a wire and picked back after the rest was removed. The core must break through the boss, so the print must be of such a length as to keep the core in position, and the part called the heel, belonging to the core, must be as much shorter than the print as the thickness of the boss, plus a little extra for clearance in setting. In placing this core, it must be brought down to its seat and pushed forward into the cavity formed by the boss, and then the open space behind the heel must be filled up with sand.

Sometimes on a cheap job where not many castings are wanted, the patternmaker does not go to the trouble of making core boxes for the class of work just described in Figs. 2 and 9, but puts on the core prints and lets the molder set plain round stock cores of the right diameter (which every foundry keeps on hand) and then stop off the prints.

Fig. 3, at *A*, shows a core placed in position, and the molder can easily hold a thin piece of board as at *C*, having a semicircle in the bottom the size of the core, in the position shown at *A*, and fill the cavity with sand, the board preventing its falling into the mold and causing trouble. At *B* the core is shown covered.

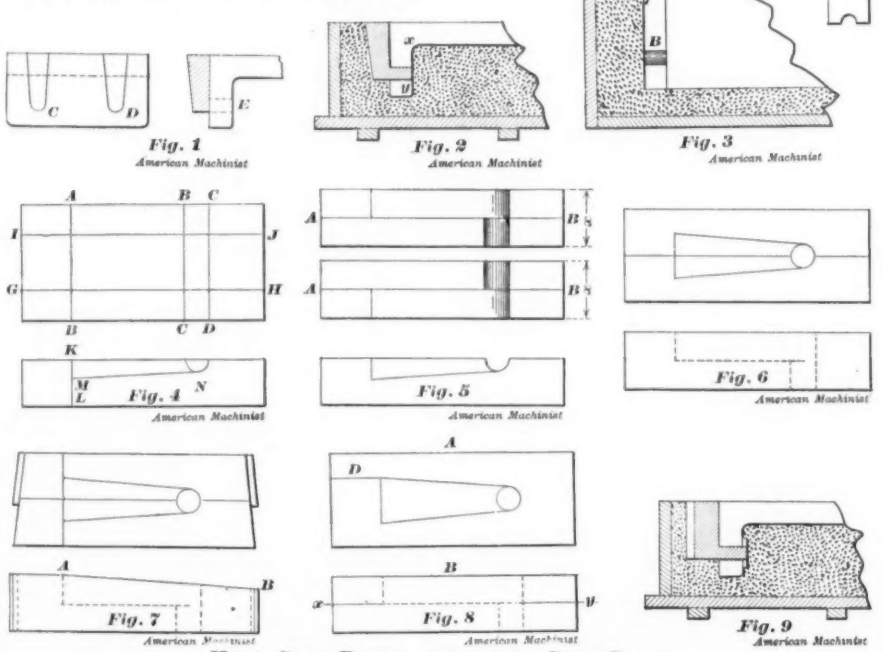
On standard work it is very much better to have core boxes, thus saving time in the foundry, and I will now speak of the construction of this class of boxes.

It would, indeed, be hard to find anything that can be put together in so many different ways, and which, in fact, are constructed by combining pieces in such a great variety of methods, each peculiar to the workman himself and at the same time finally ending with the same result, as patterns and core boxes.

Probably the quickest way to make a heel core box, and, it strikes me, the poorest one also, is to get out two pieces of stuff, one the thickness of the heel and the other the thickness of the straight part, as shown at Fig. 8, and bore a hole of the right diameter in the lower piece. Lay out the required shape on the upper one and band saw in on the line indicated at *D*, taking out the part to fit the heel, then nail to the lower block on the line *x y*, and smooth the whole as much or little as the case seems to require.

Another way is to square up two blocks carefully, of the right thickness for the box, and dowel them together near each end and then lay out the required lines upon both pieces, and work everything out of the solid stock. This makes a very nice job if carefully executed, but it takes considerable time.

An examination of Figs. 4, 5, 6, 7 will show what I consider a most excellent method, having several advantages. First, get out a piece of stock of any convenient thickness and length, and of a width somewhat greater than twice the length of the



Heel Core Prints, and their Core Boxes.

round portion of the core, plus the thickness of the heels. Square the lines *A B*, *B C*, *C D* across the top, and gauge the lines *G H* and *I J* also. The semicircle and lines *K L* can now be drawn on each side of the block, the lines on top being guides for them. *M N* should next be drawn. Two things are noticeable here, one is that every line as yet is upon one solid piece, and the semicircle is to be worked out in one piece also before being cut in two. This should be done when possible with a fine band saw right to the line, but if the curve is too small remove most of the stock with the saw and trim out with a gouge. Next, cut the block in three parts on the circular saw, first on the line *G H*, then turn the piece around and saw on *I J*, next in the middle of the remaining portion. The lines *K M N* on the first two pieces detached should now be closely followed with the band saw, and smoothed with sandpaper and glued and nailed back to the remaining pieces in exactly their former position. The appearance will now be as in Fig. 5, the joint coming at *A B*. Each of these pieces can now be run through the circular saw for the last time, bringing them to the required dimension indicated by *x*. Now turn them over and place them together and they will look like Fig. 6. The next move is to bring them to their final condition, shown at Fig. 7, which is done by sawing each end at an angle of at least 5 degrees from a right angle, and nailing on ends that shall lap over about ¼ inch on the other half, having the grain run in the direction of the angle for strength. The advantage of this is that the very instant the coremaker starts to separate the box all is free, and dowel pins are quite apt to cause trouble by sticking, while this method holds the two parts together just as accurately, and the latter trouble is avoided. One thing yet remains to be done, and that is to saw the bevel on the back of the heel part, as shown by *A B*, Fig. 7, when the box is ready to smooth up and shellac.

The Care of Heating Boilers During the Summer Season.

By W. H. Wakeman.

As the winter season is now nearly past, the time will soon arrive when boilers that are used for heating purposes only, must be laid up for a time, and a few suggestions as to the proper course to pursue may not be out of place.

In the case of internally fired vertical boilers, care should be taken to have all of the water drained from the water legs, as if any moisture is allowed to collect here it will cause corrosion and result in damage to the iron. All ashes should be carefully removed from the ash pit, for if allowed to remain in contact with the lower part of the boiler, any dampness about the foundation is sure to cause trouble, by accumulating in the ashes and attacking the iron. Scale is almost sure to have collected on the crown sheet while the plant was in operation, and none of this should be allowed to remain. It is often said that boilers deteriorate more while not in use than they wear while doing their regular duty, and this is probably true unless great care is exercised in protecting them from the agencies which tend to destroy.

If there are no hand holes in the shell, where there should be, now is a good time to have them put in. In cases of boilers that were built several years ago, a surprising lack of facilities for cleaning them out is manifest, still I suppose that those old-time boiler makers usually lived up to the best knowledge they possessed; but as time has passed away we have the benefit of further observation and experience along this line, and see where improvements can be made.

Sometimes horizontal tubular boilers are covered with ashes on top to the level of the side walls. This is certainly inexpensive, and is a very good non-conductor of heat if only fine ashes are used, but if allowed to remain there for months with no fire in the immediate vicinity, and water dropping on them through a leaky roof, external corrosion of the plates is sure to be the result.

The tubes of these boilers, whether horizontal or vertical, should be well cleaned out, and also the breeching and flue connections to chimney. Some engineers claim that it is well to fill boilers full of water when they are to be laid up for a time, then boil the air out of this water, and allow them to stand until needed for use. Others think that it is better to entirely empty them, as before mentioned, and leave them perfectly dry. We are much inclined to favor the latter plan for reasons already stated, and believe that a good coating of crude petroleum will prove of much benefit in loosening up any scale that may have accumulated, and in preventing the iron from rusting.

This may be applied with a brush, or by means of a large syringe, at small expense, but great care must be taken that no light is brought into contact with this oil, or the vapors or gases that arise from it, as several explosions have been caused in this way, and men severely burned on account of such carelessness. Some of these heating boilers are located in the cellars of large stores, where they are well down towards the level of the sewer, and in such cases the blow-off pipe should be closed again, after the water has been drained out. A certain engineer, whose plant was located in this way, left it in the spring, as he claims, with this valve closed, and went on his vacation. While he was gone the boiler inspector came and made his annual internal examination. Shortly after this a heavy rain storm came that way, and the cellar of this establishment, as well as others, was filled to a depth of several feet with water from the sewer "backing up." An examination of the premises showed that the blow-off valve was open, and that the water came in through the blow-off pipe, filled the lower part of the boiler, up to the manhole in the head, and so caused the serious damage that resulted from corrosion. Who left the valve open? The engineer claimed that he shut it, and the boiler inspector claimed that he did not leave it open, so there the matter rested. One thing is quite sure, and that is that it was open when the water was seeking a place to enter, and that somebody was to blame for it.

Notes on Piping—Faulty Fittings.

By Peter H. Bullock.

Every steam pipe supplying an engine should be provided with a drip close above the throttle valve, that is, if the pipe descends to the engine. If it comes from below, of course, the drip will have to be from the lowest point in the steam main. The accompanying sketch shows how such a drip may be provided, and at the same time furnish a by-pass that is very convenient for running slow, stopping, starting and warming up the engine. As will be seen, holes are tapped into the steam pipe both above and below the throttle, and a three-way valve used for the by-pass, and a common globe for the drip. In this case the steam pipe is 5 inches, the by-pass ¾, and the drip ½. The engine at full load and throttle runs 74 revolutions, and with the by-pass alone about 12, a very good speed for stopping or throwing on belts. With the three-way valve closed it is simply a drip for removing the condensed water from the main steam pipe. When this is done and the drip valve closed the other is ready for use as a by-pass and sensitive throttle.

There are very few establishments where more or less heating is not done with exhaust steam, and nearly as few where the amount available is just sufficient for doing the work properly or economically. Often there is too much steam during a part of the time, and not enough at other times. There need be no suggestions for remedying the first condition nor perhaps the second,

except to suggest that there are several ways of turning live steam into an exhaust pipe, and that it may be done in such a way as not only to do its work better, but also to reduce the back pressure on the engine. It is not an uncommon thing to block open the steam and exhaust valves of automatic engines, and blow through from the throttle, and I have known of a case where the cylinder drips were increased from ¼ to 1 inch pipe, and they were left open more or less according as the frigidity of the weather seemed to require. In another case they used to start up a lot of idle machinery so as to make more load and indirectly more exhaust. They were as bound to have the exhaust as was the captain to have the con-

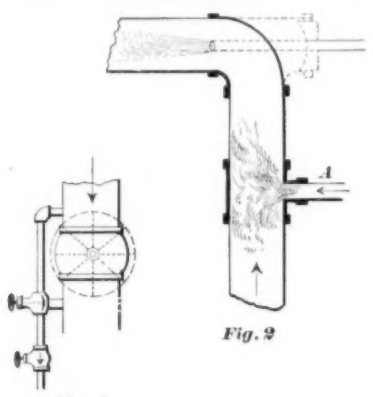


Fig. 2

Fig. 1

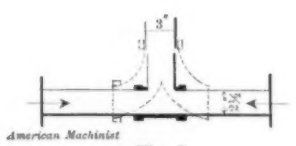


Fig. 3

NOTES ON PIPING.

verts in his company in excess of his rival, even if he had to detail a squad for the baptismal ceremony.

In a certain block of shops, the piping was arranged for exhaust heating, and in the engine room there was a 6-inch valve for turning the steam on or off as required, and also a 6x2 tee with a connection to the direct steam, so that when the 6-inch was shut off, the 2-inch direct could be opened and the shops heated up before the engine was started. This arrangement worked well enough for the purpose for which it was intended, but it so happened that certain processes of manufacture were carried on in the forenoon, requiring considerable more power than was used the remainder of the day, when there would not be exhaust enough to properly heat the shops. At such times recourse was had to the 2-inch direct steam valve for warming the building. To determine the amount of power used by a tenant, diagrams were being taken from the engine one afternoon when a call was made for more heat, which was given in the usual manner. The next card taken after the direct steam was turned on showed a marked increase in back pressure, and in order to fully understand the case, several cards were taken under the new conditions. Of course, it was expected that the back pressure would be increased by the direct steam being blown into the exhaust pipe, but it seemed as if the needed heat should be got without adding much, if any, load to the engine. The arrangement in use was as shown at *A* in Fig. 2. This was changed to the plan shown in dotted lines in same figure, the live steam being blown into the exhaust pipe through a jet of reduced area. As will be seen, the live steam being introduced through a T at a turn in the pipe, has the effect of reducing the back pressure on the engine, instead of increasing it as before. The heating is just as satisfactory, and the cost less. The gain is from the work being done in the right direction by the steam at the jet, instead of neutral work being done when blown into the 6x2 T, and impinging upon the opposite side, diffusing its volume equally in both directions, the extra back pressure on the engine representing the work required to turn back the inlet steam and force it through the heating system.

Pipe fittings as usually constructed perform the function of keeping the steam inside in a satisfactory manner, but are often so made as to be a great hindrance to the free passage of it, and they introduce an undue amount of friction by having abrupt turns, contracted passages and sharp internal obstructions. Perhaps all do not realize how much steam is obstructed by these tortuous passages, or how easily it may be deflected in any desired direction by easy smooth turns in place of rough, short ones. I recently tested some badly designed and poorly constructed globe valves that had but 60 per cent. of the area of a plain pipe of the size they were intended for. This obstruction of flow is far more with water than with steam. I know of a case where an injector could not be made to work as at first connected, but which did all right when given a free steam valve with changes also made in the delivery pipe, doing away with a few sharp turns, and replacing a globe and globe check valve, with a gate and swinging check. If anyone does not think there are great losses from friction of flow, let him locate several accurate gauges at different points on a pipe from the boiler to where the steam is used, and note the gradual loss in pressure. Or locate them on the delivery pipe of a pump to the heater, and thence to the boiler, and note how the pressure dips the other way. The difference below and above boiler pressure will represent the loss. I remember the case of a double cylinder elevator engine, the exhaust of which was piped, as shown in Fig. 3. The exhaust line in cards taken from these cylinders showed a "hump" equaling 5 pounds, at the point where the opposite cylinder released its steam. A special fitting was made, and put in, as shown by dotted lines, and the "hump" disappeared from the cards taken after the change was made. The engine ran smoother, and the car traveled several feet faster per minute than before. Very frequently builders of engines have a just cause to complain of the way the pipe connections are made by other parties, as, for instance, where a larger engine is put in, and for the sake of economy the old piping is utilized. The case of the elevator engine referred to, however, was one on the builders who designed and piped the engine in the faulty manner shown, and who refused to contribute in any way towards a better method, saying that "their engines had given satisfaction for years," and that "they did not care to change things to suit the whim of every smart Alick," whose knowledge consisted principally in "knowing how to operate an indicator." This was rather discouraging to the young engineer, but he persisted in putting on the new T-fitting, and in proving it a benefit to such an extent that they were obliged by their customers to adopt a similar scheme.

Cutting Square Thread Screws.

I think it would be difficult to find another machine shop job that so badly needs improving as the cutting of square thread screws.

I think I am safe in saying that the plan in general use in all shops to-day, modern or otherwise, is nearly, if not exactly, the same as that in use 25 years ago. Perhaps the best way of calling attention to the defects of the methods, would be to follow John Jones, a fair sample of machinist, through the process of cutting a square thread screw.

John may not be a professor in his line, but a fair average; there are many worse.

John is employed in a modern shop where system reigns supreme (except in the cutting of square thread screws). There are very few "makeshifts" to be seen in this shop, such as I have seen in old-time shops, but when John starts to cut a square thread screw, he steps to the tune of 25 years ago.

The first move in order is to find an old stub of a lathe tool, which he takes to the blacksmith, who, as likely as not, he finds busy with other work, so cannot attend to John's work just now, so John goes about the shop killing time for a while.

At last the blacksmith catches up, and John gets the tool forged, and then his further trouble commences. He has had sufficient experience to enable him to do an ordinary job of filing, but the filing of a square thread tool in a proper manner is hardly an ordinary job of filing, and John finds this out about every time he tries it.

In the first place, there is quite an exact thickness to be got, and at the same time there is the side angle and the top to be kept nearly parallel.

John gets the thickness correct before he gets the angles, and then when he tries to file the angles correctly, his "foot slips," and away goes the size.

John does not forget how long it takes to get the blacksmith to do a job, so this is quite a serious matter, but he knows it is of no use to cry over "spilt milk," so he "braces up" and gets another "stub," for he thinks best to have the blacksmith dress two while he is about it this time.

In due time the tools are dressed, and John goes about the filing job again, but not in quite so bold a manner as before, for he thinks it will pay to be cautious, even if it takes the rest of the day. But John's arm movement is not exactly a parallel movement, and he cannot seem to set the angle of that file as conveniently and accurately as the graduated head of the planer or milling machine. Caution and time do not avail this time, for luck or accident is the only thing to expect under the conditions.

It would take too much space to tell all the maneuvers that John goes through, and at last the tool does not suit him or the job.

He was working entirely in the dark as far as side angle was concerned—was only trying to get that to look right to him.

The tool that is accepted has sharp, badly shaped corners, worse than Fig. 6, for the final size was reached by cold upsetting, and then when it is put to use, the side angle is found to be incorrect, and stands in the thread something like Fig. 3. As John did not have a very good idea of what the side angle should be, he intended to give it an abundance of clearance, *to be sure*, so the tool is very weak, as in Fig. 3, and the clearance is all on one side. The form of thread cut looks something like Fig. 5, with very rough sides, and, of course, on account of the crowding of the tool due to improper clearance, and the rough and drunken form of thread, the nut will not go on, even if the tool was made the correct thickness, which, perhaps, it was not.

Now comes the "tug of-war;" that nut

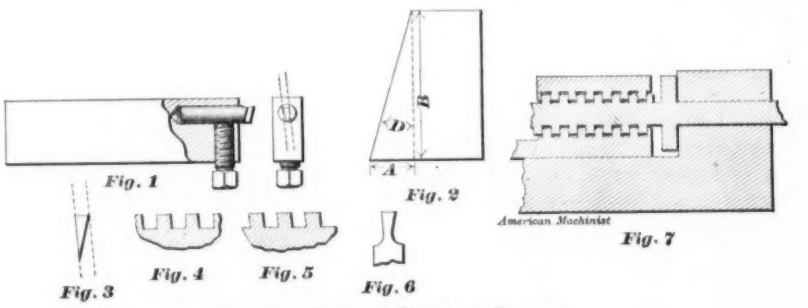


Fig. 1 *Fig. 2* *Fig. 7*

Fig. 3 *Fig. 4* *Fig. 5* *Fig. 6*

CUTTING SQUARE THREAD SCREWS.

must go on, so John gets it started, and tries to force it, when perhaps it will rough up, and then he cannot get it off, but if he has luck he will manage to get it on about half its length, and off again the same day. Now, he tries to see where it bears, but the thread will not admit the light well, so this is difficult. He tries experiments, and a great many kinds of "monkeying," gets out of patience, and wishes he had never learned the trade, at last the nut goes on, and he does not know what particular move on his part was the cause. The next time he has a square thread screw to cut he goes over very nearly the same ground again. You ask John Jones what he thinks of square thread screws, and he will tell you about the same as he does of the "realms of darkness," that is, something to be avoided. You ask him if he thinks an angular sided thread would be better, and he will fall right into the notion.

John is not the worst machinist in the place; there is Bill Smith, one of the "lightning machinists," who thinks the square thread screw is all right—*sometimes*—when he has luck. Bill Smith is never bothered with any little matter of side clearance; an ordinary cutting-off tool is what he considers the ideal, and when he finds one about the right thickness he feels in luck.

The right thickness with Bill is a thickness that will let that nut on with about as much freedom as a rat has in a barn door, supposing it does not crowd, but it does crowd in an astonishing way, so Bill's form of "drunken" thread will fit perfectly almost any nut that is wrung on to it. Sometimes Bill has hard luck; that particular cutting-off tool happened to be badly cleared for a cutting-off tool, but happened to be about right for Bill's thread, so the nut goes on in a way that makes the boss sick, and then the boss proceeds to make Bill sick, and that is one of the times that Bill does not like a square thread screw. You go about a machine shop, and you will find many who do not like to cut square thread screws, and when you inquire for the reason you will find in most cases about what I have outlined.

My opinion is that if the job is gone about as it should be there is no objection, as a lathe job, to cutting a square thread screw, and this opinion is based upon considerable experience.

It is simply a question of good tools, as in many other things. To cut a square thread screw after the tools are made correctly is a simple lathe job. The side clearance on a square thread tool should not be made to guess unless the workman is much more than an ordinary guesser. I have always found that when a square thread tool is well formed it will cut in a satisfactory manner, but when not properly made, when made with negative clearance on one side and very rakish and sharp cornered on the other, I for one do not see how it can be expected to work right.

There is no need of guessing at the side clearance of a thread tool, for it is very easy to make a diagram on a piece of paper or tin, such as is shown in Fig. 2, in which *A* is the pitch of screw, *B* the circumference, and *D* the angle of thread that the tool must follow.

A plain diagram on a piece of paper, just to set a bevel, is much better than guessing, but if the diagram is made on a piece of sheet metal and then cut out as in Fig. 2, a tool is produced that can be used inverted, so as to try each side of the lathe tool. I do not favor filing such tools as a common practice. It takes an expert filer to do a good job, and that good job costs much more than milling, if you have a rig for the purpose, and if not it will pay to make one, if you have much of such work to do.

Some time ago I furnished a sketch to the AMERICAN MACHINIST of a tool as in Fig. 1.

This was originally intended for ordinary turning or boring, the holder being convenient for holding short pieces of Stubb's steel for ordinary boring or turning tools, but I think it would be hard to beat for cutting square thread screws. It is evident that the proper side angle can be very easily obtained. Better steel may be had for cutters than where a point is forged on an ordinary lathe tool, and not least, by any means, of its advantages is the fact that there is a cheap and good way of making such cutters without filing.

I have no doubt that where only one cutter is wanted it can be filed, by a good man,

as cheaply as in any other way, but where many square thread screws are cut it will pay to make a quantity at a time and keep them in stock.

The steel may be cut to proper lengths with a shear or in the lathe, then by holding them in a chuck on the dividing head of a universal milling machine, with a sharp end mill, first flat the top of tool, then index the head one-quarter turn and a sufficient number of holes extra to make a proper side clearance, when one side may be milled, and then by indexing one-half turn and the same number of holes extra, the other side may be milled and the correct thickness obtained very easily. Such cutters may be made ready for use for a few cents each. I should think it would be a good article of manufacture, and there ought not to be great fear of the adoption of any angular-sided thread forcing them off the market. I am aware that square thread tools have been made after the fashion of patent cutting-off tools, that is, a long thin blade fitted to a holder, but such tools lack rigidity.

The best square thread tool is where the point is short; a bad mistake is often made by making the point long to allow for grinding. It is better to make points short and use more of them.

Many men make a bad mistake in thinking they can know at once exactly how thick to make a square thread tool. The thickness of a square thread tool is largely a matter of experiment; it depends very much on how nearly the pitch of lead screw of lathe you propose to use agrees with that used to originate the threads of nut. If I were making up a stock of square thread cutters I would not make all for a certain pitch of the same thickness exactly, but of varying thicknesses, so, if after cutting the first screw on a given lathe, I find the thickness of tool incorrect, I could try another.

If a record was kept of such jobs, designating the particular lathe used, length of nut and the amount the tool needed to vary from the theoretical thickness, it would be found valuable for future reference. I can imagine someone putting all this complication against square thread screws. Now let us consider how much force there would be to such objection. If you have a thousand 1-inch holes to bore of exactly (or nearly so) the same diameter, it will pay to make a reamer rather than bore each to size in the lathe with ordinary boring tool. If you have a thousand screws to cut with angular thread, you must make each fit separately, as in boring the holes, but with square thread screws, you may take more time to get the tool right at first, but when once right, like the reamer, it makes the fits for you. Then there is the varying diameter of an angular-sided thread screw that changes the pitch, which is not true with a square thread. I fail to see how an angular-sided thread screw can be cut so nearly to the pitch of leading screw as can be with a square thread. Many will make a square thread tool as in Fig. 6, which is a top view, this unless used on a remarkably good lathe, and on short, stiff work, will make rough-sided threads, and in case the side angle is incorrect, as in Fig. 3, it will make a drunken thread of the style shown in Fig. 5, or one of Bill Smith's kind. Bill makes two kinds of drunken threads, the other being shown in Fig. 4, in which case the top of tool is unlike Fig. 6, being parallel sided, the angle at left side being caused by the tool having negative clearance on that side.

Bill sometimes has trouble in getting the nut to start over a thick thread at end of screw, and after passing this thread, having it go "swimmingly." This bothers Bill very much, almost as much as it does the lathe tool.

A large part of the difficulty with square thread taps may be avoided by getting them of a more uniform pitch, and in slightly clearing the sides of teeth. I don't mean to file clearance, but such tools are coming to be made in factories where they can afford to have special machines for this purpose, which will do the work cheaply and well. Another help is to make the taps shorter, and more of them, each with its thread of the same thickness and the same diameter at bottom, but an increase in each successive one in outside diameter. Large square thread nuts can often be cut in the lathe with a suitable boring bar, and where this is practicable, a much better thread can be obtained than with any tap and without much additional cost.

In Fig. 7 is shown a section of a nut, slide and square thread screw. I think those persons who are advocating the abandoning of square thread screws for such purposes, would do well to consider the difference in cost between this and substantially the same thing, with an angular-sided screw.

A careful designer will so make things that they can be produced without needless expense.

In your issue of January 24th, I notice Mr. Powell has said that the only advantage the square thread screw has, "worth considering," is in less friction than angular threaded screws.

Mr. Powell mentions the weakness of square thread tools as an objection. I have had some experience in cutting half V threads, and in every case, so far, I have found it a decided advantage to cut down first with a square thread tool, and then in long slender screws, I found I had to be very careful in letting the angular-sided tool touch bottom at all. In roughing out a half V-screw with a square thread tool, it is evident that a much weaker tool must be used than in cutting a regular square thread, so the weakness of tool will hardly count against a square thread.

Long screws that are cut in the lathe require the use of a follow rest, and the square thread allows of the best and greatest surface to run in the rest.

The square thread tool takes out a flat chip which easily curls up and gets out of the way, where the half V takes a trough shaped chip that will not curl, and only gets out of the way when it has been crushed to pieces, so such tools are hard working, unless they are only used to cut on two sides, the bottom being first roughed out. As far as "take up" for wear is concerned, I believe such adjustment would not be useful in most cases, were it provided. No one expects the fit of nut on cross-feed screw of lathe to positively prevent all end motion of tool block. I have heard it stated that when an ordinary machinist examines a lathe, about the first thing he does is to see how much backlash there is in the screws; I don't know about this, but I think I do know that one of the last things he thinks of in using the lathe is this very same. If we were obliged to keep every bit of backlash out of such screws we would not find time to do much else.

In your issue of January 31st, Mr. Raylance mentions difficulty in cutting screws on account of backlash in lead screw nut. I think if he had a good carriage properly fitted, and of sufficient weight, he would not find any difference, however much backlash there was.

Very much backlash will cause a loss of time and of energy, but a little is always found, and is not usually harmful. Coming back to the cutting of square thread screws, a word about how many tools to use is in order. Some use a rougher and a finisher, while others use only one tool for both roughing and finishing.

Bill Smith can cut just as good a thread with only one tool as with two, for he would not have either of them right, unless by accident, and the accident would most likely fall at the wrong end of the job. It will take more time to cut a good screw with two tools than with one, for the finisher must be fed down slowly or a rough-sided thread will be the result, and for ordinary work one properly made tool will rough out and finish a screw good enough.

I think most fair-minded mechanics will say that there is more than one thing to be considered before the *good* old square thread screw is made a thing of the past.

A Mechanic.

Polishing and Buffing Frame.

Polishing and Buffing Frame.

This is a very heavy substantial machine, and was designed more especially for bicycle manufacturers and the like, where constant running and hard work require a very stiff frame. The boxes are of cast-iron, are removable, and can readily be duplicated. The top of the yoke can be removed, and the whole arbor lifted right out. It has nickel-plated self-oilers. All machines are furnished with one taper-screw in end of arbor. The arbor is 4 feet long, 1½ inches diameter in the boxes, journals are 6 inches long. The base is 18 inches by 22 inches, and the machine weighs 330 pounds.

It is made by Perry Ransom, Oshkosh, Wis.

The Steam Engine Indicator.

Harris Tabor, M. E., by invitation, delivered a lecture before the New York Engineers Protective Society, No. 23, of the N. A. S. E., at their hall, 8 Union Square, East, February 27th, an abstract of which we publish as follows:

If a man with a fair knowledge of the steam-engine indicator had been called upon to address an audience of stationary engineers upon this subject twenty-five years ago, his task would have been comparatively easy. At that time few engineers, in fact, few men in any profession or calling, were familiar with the construction and functions of this little instrument which has done so much toward revolutionizing steam-engine practice. The occasional expert who was the possessor of an indicator, shrouded his profession in such mystery that we laymen could only look on with admiration and awe. In those days, when an audience could not detect truth from quackery, a little knowledge on the steam-engine indicator and its application might pass for volumes. But you are not an audience of a generation ago. You belong to the closing years of the nineteenth century, and you have kept even pace with the designers and constructors of steam engines, steam-engine indicators, and all that represents progress in steam engineering. Your care and intelligence in the engine room have made steam-engine improvement possible; you are a factor in each improvement, without which the engine builder's progress would have been much slower. The designer of high-grade engines does not now give a thought to the attention his engine will receive in the engine room, for he knows your association is advancing with him; he knows that your skill as engineers is equal to the best product of his brain, and he knows, moreover, that you are good critics, who will condemn any device that does not possess merit. The result of this combination of your skill and intelligence as engineers, with that of the designer, is giving us steam engines to-day which are marvels of excellence, but which might prove failures without your skill in the engine room. All the elements of steam economy, such as high steam pressure, small clearance, and liberal expansion call for greater intelligence in the engine room. Recent tests which give a horse-power at a cost of less than 12 pounds of steam per hour, prove that you have supplied that intelligence on demand, and you will continue to respond when demand is made.

You are as familiar with the history and construction of the indicator as I am; you know it in all its various types, its good qualities and bad. You understand the manner of taking diagrams, and your experience will readily suggest when the card is about right. Anything I can say to you on these points will be "threshing old straw," which I want to avoid.

The indicator in itself means no more to the engineer than a pump over a dry well means to a thirsty man. It is the work done by this instrument, the lines it makes that interests us—lines which show at the first glance just how much the engine designer has blundered, or how well he has designed. It is of the indicator card and its various lines that I shall speak to-night, and I do it with a feeling that to many of you I shall say very little that is new.

The area of the indicator card always represents power developed by the piston of the engine, and the weight of steam at the terminal or exhaust represents the cost of power. The weight of steam at terminal is determined by its pressure, hence it follows that the card which contains the greatest area within the admission, steam, expansion, exhaust and compression lines, with the lowest pressure at the terminal, is our ideal card. The conditions in the steam engine necessary to secure these results are small clearance, liberal expansion, ample steam ports, and quick opening and closing of valves. Mr. Corliss must have had this theory in mind when he designed his celebrated engine, for his original machine, more than any other up to that date, contained these features. In fact, all improvement on this type of engine, aside from better construction, has been in the direction of making cards with larger relative area and lower terminal; it may be said that nearly the entire engine trade is now pointing in the direction of greater expansion of steam. If we had only expansion to deal with, the problem of getting cards with large areas and low terminals would be comparatively easy. Unfortunately, too much expansion begets that greatest foe to steam economy—condensation. If it were not for the loss from condensation we might get almost unlimited expansion in one cylinder, and there would be no need of steam engines with two, three, and four cylinders. When you see a fine diagram like No. 1, and you admire the downward curve of the expansion line, you must keep in mind that this represents heat going into work, and that the reduction in pressure means proportional loss of heat and cooler cylinder walls; you must also keep in mind that this reduced temperature in the cylinder can be restored only by the incoming steam on the next stroke, and this means initial condensation. If expansion in one cylinder is carried too far, the loss from condensation is greater than the gain from expansion. With boiler pressures that were common ten years ago there was little danger of too many expansions in a simple engine, and when it did occur, someone had blundered by ordering too large a cylinder for the work to be done.

The great ocean liners, and the numerous large power plants on land which have come into existence within the past few years, have called for greater steam economy on the part of the engine designer; and with this demand came a call for condensed power. It was no easy task to encompass within the hold of one ship 30,000 horse-powers with coal bunkers ample for steam-

ing 3,000 miles at a 21-knot pace, still leaving carrying capacity for crew and passengers numerous enough to populate a small city. There was but one way to get this double gain of condensed power and better coal economy, and that was through higher steam pressure, which meant expansion of steam in more than one cylinder. Here we have, not the origin of the compound engine, for compounding with too low steam pressure was tried before many of you were born, but the revival of this system.

If you will look at drawing No. 1, which is an enlarged diagram from a simple engine, with an initial pressure of 79 pounds above zero, or the vacuum line, expanded down to 20 pounds, you will see that the steam has passed through a range of temperature from 296 degrees to 216 degrees, a change of 80 degrees; now, if you will give your attention to the next drawing, No. 2, which is an enlargement of a pair of diagrams from a compound engine, showing the action of steam through both cylinders, you will observe that steam expanded from an initial pressure of 121 pounds to 30 pounds in the first cylinder, with a further expansion in the second or low-pressure cylinder to 8 pounds, giving a range of temperature between 341 degrees and 182 degrees, a change of 159 degrees. It is very evident that an attempt to get the same number of expansions from a single cylinder that diagram No. 2 shows, would be attended with serious loss from condensation. As higher steam pressures are used, and the number of expansions increased, more cylinders are added for the purpose of keeping the range of temperature in each cylinder within economical limits. You are familiar with triple and quadruple expansion engines; these are simply the results of high steam pressure, and more liberal expansion.

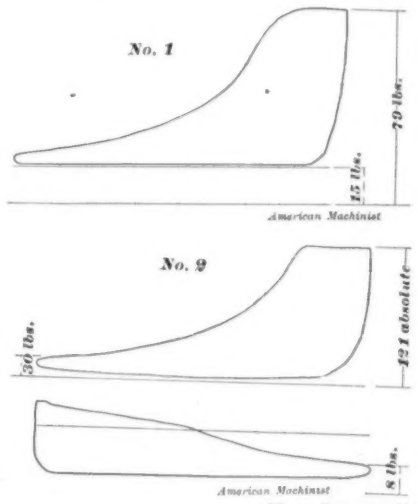
Many of you are trying to reconcile my statement that our ideal card is one which has the largest area with the least terminal pressure, with my later suggestions regard ing the danger of over-expansion. I know there seems to be a contradiction, but if we analyze the compound diagram that discrepancy will disappear.

The indicator card is a map showing the action of steam throughout the whole cycle of the piston's movement. It is a record of the steam from admission to exhaust, and no card is complete which does not indicate every change from the time the steam enters the cylinder, or cylinders, until it passes into the atmosphere or condenser. In treating a card from a multi-cylinder expansion engine, we must consider the combined area of all the cards, according to their scale, for the power developed, and we must get the cost of that power at the terminal of the low pressure, or last cylinder in the train; it is at this point that the useful work of steam ends, and here we must get our cost. We have seen that we cannot expand too much in one cylinder without loss, we know our only way to further economy is by greater expansion, hence our present tendency toward higher steam and multi-cylinder engines.

The engines from which these diagrams were taken belong to the slow or medium speed type. You will see by the rapid fall in the expansion lines and the quick rise in the compression that the clearance was very small, and this small clearance is obtained by making the stroke relatively longer. Such engines are probably more economical in the use of coal than the high speed type, with larger clearance, but it does not follow that they are more economical when all things are considered. Their first cost is much greater, to which must be added real estate, more expensive foundations and generally a system of countershafts. All this means an interest and maintenance account, which may be more than the difference in the cost of fuel. Economy cannot be gauged from one day's run, or from the performance of a week; it should be calculated after the bills for a year are in, and the engine which will furnish the motive power for the least cost in fuel, attendance, repairs and investment account, is the cheaper engine. It is important that the factory wheels turn every day with uniform speed, and this should be taken into account as well.

The indicator often makes lines which are not such marvels of excellence as Nos. 1 and 2. The fault is often due to bad valve setting or poor valve construction, and it is occasionally due to the indicator. We have all seen diagrams with the steam line wavy from start to finish, and we have heard a multitude of causes given for these irregularities. The usual reason assigned is water which comes in such volume that its inertia carries the indicator piston too far. This is all very good for discussion, but the chances are that if water passes in such quantities to your indicator, your engine will not escape disaster, and as you do not break a cylinder head when you get such cards, it is fair to assume that these irregularities are due to other causes than water. We will consider what seems to be the most logical cause.

Diagrams Nos. 3 and 4 are from high-speed engines, both taken at a speed of 350 revolutions per minute. The steam and expansion lines on No. 3 are about as smooth as a draftsman would make them, but these lines on No. 4 are quite irregular. You will notice that on each of these cards is plotted a circle which we will call the travel of the crank. Now, what I wish to bring to your attention is the element of time, and the influence it has on the indicator piston, spring and pencil movement. All these parts have weight, and consequently inertia. If their movement is relatively slow, the inertia, or tendency to go too far, is slight, and our diagram will be smooth; but if this motion is rapid, or performed in unusually short time, the inertia will be great, and a



The Steam Engine Indicator.

diagram with irregular lines will be our product. The valve motion of a steam engine influences this time, and in these cases before us there is enough difference in the valve motion to account for all the difference in the lines of the diagrams.

By referring to the diagrams I will endeavor to make my meaning clear to you. On No. 3 you will notice that the indicator piston begins its upward motion at a point marked *A* on the exhaust line; at this time the crank is at *A* on the circle. If you will follow the compression line, and keep the crank circle in mind, you will see that when the indicator pencil is at *B* it has reached its limit of upward travel, and the crank has passed on to its point *B* through 92 degrees of the circle, or more than one-fourth of its entire travel. Here we have a high-speed engine, so far as rotation is concerned, but an easy speed for indicating, because the large clearance and early compression makes the movement of the pencil so gradual that severe inertia shocks are absent.

Diagram No. 4 is lettered the same as No. 3, but note the difference in the location of the letters. Compression did not commence until the stroke was nearly finished, and it rose only a few pounds. Ninety per cent. of the upward movement of the pencil is represented by a nearly vertical line, showing that this motion occurred while the crank was passing through a very small part of its travel. If you will compare the difference in the spaces between the letters *A* and *B* on the two crank circles, you will get a fair idea of the difference in the velocities of the pencil movement when these diagrams were taken. This difference is the measure of the disturbance shown in the steam line of No. 4. In No. 3 you find all the conditions which insure a smooth card, and in No. 4 quite the reverse.

In your experience in indicating you will occasionally get cards from slower running engines which show all the irregularities found in cards from high-speed engines; if you find violent vibrations in the steam line do not condemn your instrument until you have carefully analyzed your diagram, and when you do make your analysis you will probably discover that your indicator has had little help from compression, and the steam admission was very quick. If you study the trade literature of the indicator you will find that high-speed diagrams published by indicator and engine makers are usually taken from compression engines, that is the single-valve automatic type which has large clearance and early compression.

One of the most encouraging features in the steam-engine trade to-day is the growing familiarity of the stationary engineer with the indicator. Many of you own instruments, and the majority of you understand diagrams, and can discriminate between good and bad engine performance. Your advice often decides the type and size of engine purchased. In the larger plants you are becoming the consulting engineer of the establishment, and all power-transmitting machinery is placed in your hands. As you attain more knowledge of the theory of steam engineering, you will have greater trust imposed in you; you will find the owner of the plant quite as willing to unload responsibility as you are to take it up, but you must be ready for the task before you accept it. Your skill and ability mean more than promotion in the engine room; they touch the future of the steam engine. Every refinement in the steam engine which points to economy calls for better care and more intelligent work in the engine room; if your association does not advance with the engine designer we shall soon reach the limit of improvements.

The problems you will have to deal with are none too easy. We can talk glibly of 250 pounds of steam when the other fellow runs the engine, but when we see the gauge hand move around to that pressure in our own engine room, we begin to look serious, and if a few degrees of superheat be added to this high pressure, the face will assume a still graver appearance. A few weeks of experience with stuffing boxes, joints and bearings, will furnish ample evidence that we have a problem on our hands at last, and that every-day use of high steam pressure is not an all-around picnic. We are drifting towards much higher steam pressure, and possibly superheat. These seem the only avenues to the saving of that last quarter of a pound of coal which our great power plants are demanding. It is easy to design engines which will stand the extra strain, but to run them is a different matter. You will determine the limit of steam pressure in the coming engine. This shows how closely your association is identified with the progress of the steam engine.

I want to say a few words to you of the three men who have done most to popularize the steam-engine indicator—Mr. Chas. T. Porter, the father of our high-speed system, Prof. C. B. Richards, the inventor of the indicator which bears his name, and Mr. Joel Sharp, president of the Buckeye Engine Co. When Mr. Porter began his experiments with high speed, there was nothing which enabled him to determine the action of steam in his cylinder at the piston and rotative speeds he wished to attain. He had no means of determining the size of steam ports or pipes required—all was guesswork. He appealed to his friend, Mr. Richards, and the result was the "Richards indicator." It may be said that the invention of Mr. Richards was the first reliable indicator. Watt used a crude form which was modified by others, but the indicator never came into extended use until Mr. Richards' invention made its general application possible. It is probable that no invention since the time of Watt has had such a wide influence in perfecting the steam engine as the Richards indicator. As our engine speeds increased, the moving parts in the Richards indicator proved too heavy, and it was left to others to design lighter instruments. The essential features of the Richards—the parallel motion and multiplication of pencil movement—are retained in all modern indicators. It is only fair to say that Mr. Richards, more than all others, is the inventor of the modern indicator.

Mr. Porter is an enthusiast on the subject of steam. He put his whole energy into the development of his engine, and the Richards indicator. How well he succeeded is best attested by the fact that high-speed engines may be found running in nearly every city block, and usually with an indicator cock in each end of the cylinder. Mr. Porter's treatise on the steam-engine indicator has passed through many editions, and it is still very popular.

All of you who have read the catalog of the Buckeye Engine Co. have taken in a very instructive lecture on steam-engine performance, and indicator practice, by Joel Sharp. You will find evidence of his thought on every page, and in every formula for determining the economy of the engine from the indicator diagram. Their catalog issued in the centennial year was noted for the information it contained; it was a text-book for the engineer and engine buyer. It is doubtful if any book has ever been published which has done so much to educate the masses in steam engineering, and to make the use of the indicator general. There are many here to-night, I with the rest of you, who can trace our first real interest in the steam-engine indicator, to the catalog of the Buckeye Engine Co. For this we must hold in grateful remembrance the name of Joel Sharp.

All War Requisites Furnished.

Proprietor of Iron Works—If I understand you correctly, you wish to place an order for armor plate that no cannon shot can pierce. We are turning out that kind of thing every day, and——

Agent of Foreign Government—No, you misunderstand. I wish to know if you can manufacture a cannon that can pierce any armor plate.

Proprietor—Certainly, sir. We are doing that kind of thing every day.—*Chicago Tribune.*

The talk of a combination of sewing machine manufacturers is again revived.

LETTERS FROM PRACTICAL MEN.

Computing the Horse-power of an Engine.

Editor American Machinist:

In addition to the articles which have appeared on figuring the horse-power of an engine the following is offered as a simple, easily-remembered method which has been useful to the writer:

Squaring the cylinder diameter in inches and dividing by 2 $\left(\frac{d^2}{2}\right)$ gives the I. H. P., neglecting piston rod, at 40 pounds M. E. P. and with 525 feet piston travel.

Many engine builders base their commercial rating on 40 pounds, and an average piston speed is, perhaps, not far from 525 feet. Starting from this formula our slide-rule friends can get the horse-power at any speed with a single setting.

Take the case supposed by Mr. Nickel, in your issue of January 31st, an 8-inch cylinder, 40 pounds M. E. P., and 200 feet piston travel, $\frac{8 \times 8}{2} = 32$, the horse-power at 525 feet. Set the runner on rule to 8 on *D*, draw slide to the right till 525 on *B* stands under 32 on *A*, then over 200 on *B* is the 12.2 horse-power given by Mr. Nickel, and over any other speed on *B* is the corresponding horse-power on *A*. Notice also that on the runner at *B* is 1,050. This 1,050 then becomes the horse-power constant used in the following rule for any engine:

A		Find H. P. at 40 lbs. M. E. P.
B	Set 1,050	On any piston speed.
C		
D	Over cyl. diam.	

To modify this result for any other M. E. P. than the 40 pounds which is most used:

C	Set 40	Under any M. E. P.
D	On H. P. given above.	Find corresponding H. P.

To get piston speed "Pickworth's Manual of the Slide Rule" gives

C	Set Stroke in inches.	Find piston speed in feet.
D	On 6	Over R. P. M.

New Britain, Conn. Robt. S. Brown.

Weight and Mass.

Editor American Machinist:

Observing the communications in the American Machinist on *weight and mass*, it may not be out of order to call the attention of your readers to an admirable text-book of "Elementary Mechanics," by Prof. E. S. Dana, of Yale. I recommend it 1st, because it may be read by anyone whose mathematical training is limited to algebra and trigonometry, and 2d, because there is a large number of exercises arranged at short intervals. By solving these problems the student may easily convince himself that he has mastered that part of the subject which he has studied, the answers being given at the end of the book.

This volume certainly fulfills the promise of the preface, viz., "to present the fundamental principles of the subject in logical order and in as clear, simple and concise a form as possible, yet without any sacrifice of strict accuracy."

It is published by John Wiley & Sons, and costs $1.50. Frederic R. Honey.

New Haven, Conn.

The Best Engine Setting—Referred to Our Readers.

Editor American Machinist:

The writer lately set four 250 H. P. engines; the owner required them to be set in cement, that is, the engines being set in line and leveled up by wedges, then a mixture of equal parts of cement and sand, with water to make a free flowing solution, was poured under, filling all the bolt holes, and also under the engine; As it set, the cement would shrink away from the iron, causing considerable trouble to follow and fill it up.

I have always set engines in sulphur, believing it to be easily applied, solid and durable. I am informed that oil gets into the sulphur, and causes it to disintegrate and crush out, while cement will not do this. Will you please inform me what is the latest and best practice? Some other engines were being set in the same place, and after leveling, a rust joint of sal ammoniac and iron filings was forced under the frame.

Please give me a comparison of this method with the others.

Can you inform me what are the ingredients used in making the surface of fine paper, such papers as use "kaolin" as a filler or base? Sam'l T. Williams.

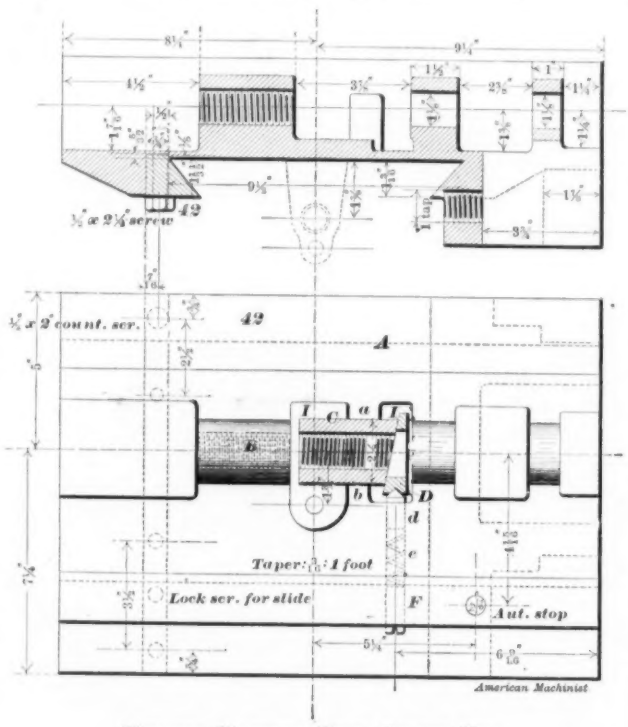
Baltimore, Md.

A Milling Machine Feed Screw Nut.

Editor American Machinist:

With great interest I have followed the comments on milling machine feeds in regard to "with or against the cutter." Of the different suggestions to take up the lost motion in the feed screw, and especially in the worn part of it, I like Mr. Bauer's device described in your issue of February 21st, best, though it evidently throws the screw slightly out of alignment and causes a constant friction in the nut.

About a year ago I devised an arrangement, which is, in principle, very similar, to Mr. Bauer's, but does not impair the alignment of the screw, and properly adjusted,



Milling Machine Feed Screw Nut.

causes no undue friction in an evenly worn, or new screw.

In the inclosed blue print, *A* represents the saddle for the table, with nut *B* all in one piece. In the recess *I*, is placed the nut *C*, having a working fit between the reinforcements *a b*, to keep it from turning. The nut is beveled off at one side, and between this bevel and a shoulder formed by the saddle, fits the wedge *D*, which has an oblong hole to let the screw pass through. It is obvious that by pressing the wedge between the nut and shoulder, the lost motion in the screw will be taken care of at the two outside faces of the fixed, and loose, nuts. The adjustment of the wedge is done by screw *F*, spring *e*, and plug *d*, accessible from the outside of the saddle. As the plug is guided in the saddle, and counterbored into the wedge, the latter is prevented from turning. The angle of the wedge is chosen 13 degrees, so that, above the friction, only a small lateral component of the end thrust of the feed screw, is exerted on the wedge. The spring, butting against the wedge, is comparatively strong, so that under ordinary circumstances it holds the nut in place without being compressed, and only comes in play when the less worn parts of the screw pass the nuts. Each nut is 3 inches long to have ample wearing surfaces.

The device works in more than 25 machines, very satisfactorily.

The feed screw thread is of the square form, which I prefer where absolute alignment is necessary, and for all other reasons, so well defined by Mr. Oberlin Smith in your issue of February 14th.

H. Dreses,
Chief Draftsman,
The Lodge & Davis M. T. Co.

Cutting Pipe Threads.

Editor American Machinist:

In your issue of January 31st, is a letter from me on the above subject, which has evidently been modified by some wielder of the blue pencil, in such a way as to make it say things which I never intended to say. The idea that I meant to convey was, that we took the die stock spoken of, and placed it on the end of the pipe, in position to cut the threads, the same as though we were going to turn it by hand, but instead of doing so, we fed the carriage, steady rest, and pipe with the die stock placed upon the end of it, up to the head stock, until the bolts on the die stock engaged with the slots on the lathe face plate. We then started the lathe, and fed the pipe in to cut the thread. Though this is what we actually did with the job, it is evident that it would not be so understood from the letter as it appeared.

W. H. Wakeman.

Boiler Explosions.

Editor American Machinist:

Every month brings us tidings of a large number of boiler explosions, of greater or less violence, according to circumstances, and in a majority of cases, one or more persons are killed, and others maimed for life.

Sometimes a reason is given for the failure of the boiler, and sometimes none is mentioned, but very many times we are told that the water was allowed to get low, the plates became overheated, and when the water supply was turned on, steam was generated faster than any safety valve could take care of it (although no one ever sees the gauge indicate it), and finally the sheets part, and all is ruin and disaster. Now the point that strikes me as being rather curious, is this: A few years ago someone whose name I have forgotten, conducted a series of careful experiments in order to find out whether a boiler would explode under such circumstances, or not. The boiler to be experimented on was fired up in the usual way, and then the water was allowed to get low, and as the fire was kept burning, the plates soon became very hot. Water was then pumped in, but no explosion followed. This was tried several times, the water being pumped in slowly at times, and rapidly at other times, when the sheets were red hot, and when they were only well warmed up, but in each case the result was practically the same, namely the sheets were bulged, warped, and twisted, but no explosion took place.

If boilers are so frequently exploded in this way, in daily practice, why is it that the same results could not be obtained when every effort was made to produce them? I wish that some of our friends would explain this mystery to us, for up to date I have been unable to understand it. I was particularly impressed with the fact that for some time after the publication of the results of these tests, we read but little about boilers exploding from low water, but as time passes on, this cause is assigned in more and more cases, until it appears as if it would soon be the universal reason given for these disasters.

It seems very strange that if this lack of water, followed by an abundance of it, is so sure to cause an explosion in practice, that it produced the opposite result when someone was there making observations and prepared to report what took place.

Will someone please explain?

W. H. Wakeman.

The Proposed New Screw Thread.

Editor American Machinist:

I have read in your issue of January 24th, of the proposed Powell thread, with interest and approval, for I think it will be far superior in strength, at least. But in regard to cutting, I find it a little bit harder to get a smooth job, in iron or steel, at least with what little experience I have had.

In regards to the clearance of a square thread tool having to be so much, I have found that by finding the angle the thread will be, and making the tool with the same angle, you have as heavy a tool as a cutting-off tool. Of course, it will take a little work and figuring, and neither can you cut a right-hand, and a left-hand thread, with the same tool, but the tool will be much stronger, especially with a coarse pitch.

Again, to the new proposed thread, of course it can be fitted more accurately, and will be very much stronger.

I had an occasion to make ten 8-inch screw jacks, to take the place of some old ones with square thread. They were 1½ inches in diameter, and 4 pitch. They had trouble with them, on account of the threads stripping.

The foreman said he wanted to try some other thread, so I proposed the regular worm thread, and I was told to go ahead, and make them, That was over a year ago, and they have not been brought back to the shop since, so I guess they are doing good work.

I made them the full worm depth, so of course I had a little trouble, as the point of the tool was very small. But with Mr. Powell's proposed thread, the point of the tool will be .015 wider, and that helps considerably in the strength of the tool.

Chicago, Ill. C. F. Englebert.

The Proposed New Screw Thread.

Editor American Machinist:

Having noted with considerable interest the articles in relation to "The Proposed New Screw Thread," in your editions of January 3d, and 24th, and knowing of the use of a screw of this kind somewhat previous to any date mentioned, I send the following, as it may be of interest to you:

The screw thread above referred to was made in our works in 1888, and was designed and made by Mr. E. W. Fawcett, and Mr. E. A. Benedict, and differed from Mr. Powell's thread only in the angle, which was 30 degrees, instead of 29 degrees, a difference which would be very slight in any practical working of this screw. Three different threads were made, and used, and have been in constant use ever since, with the most satisfactory results.

The screws made were as follows:

$1\frac{7}{8}$" outside diameter, 4 threads,
$1\frac{15}{32}$" outside diameter, 4 threads,
$1\frac{31}{32}$" outside diameter, 3 threads,

and were cut, with an adjustable die, without any trouble, and made an excellent screw, and, as it seemed to us, a perfect thread.

Clearance was allowed in the nut, as suggested by Mr. Powell in his recent papers.

W. H. Moulton,
Supt. The Deming Co.

Salem, Ohio.

Strains in Fly-wheel Arms.

Editor American Machinist:

The bending strains on fly-wheel arms, due to accelerating or retarding forces, can be calculated by methods identical with those used in the calculation of the stresses in a beam with fixed ends.

In Fig. 1, *o* is the center of the wheel, and *o s* the arm, neglecting the hub. The original position of *s* is at *r*, but the rim has moved through an exceedingly small distance, represented, much exaggerated, by *r s*. Assume the arm to be of equal section through its entire length, then it is evident that it will be bent as shown in the figure,

and that there will be a point of inflection somewhere between s and o, say at p. If we can locate this point the problem is solved, for then the arm may be considered as two beams fixed at o and s respectively, with their free ends meeting at p where the load is supposed applied. Draw tangent at p, making an angle q with the straight line $o\,s$, and let v be the angle between the original and new position of the arm. Let c be a constant factor depending on the external bending force, the moment of inertia of cross-section and the modulus of elasticity of the material; then

$$q = c\,a^2 - v,\ q = c\,b^2, \text{ and}$$

$$v = \frac{m+n}{a} = \frac{\frac{2}{3}\,c\,a^3 + \frac{1}{3}\,c\,b^3}{a}$$

$$= \tfrac{1}{3}\,c\,\frac{a^3 + b^3}{a}.$$

From these equations we get by common algebra $a = 2\,b$. That is, the bending strain at s will only be half the bending strain at o. It will not do to neglect the angle v as

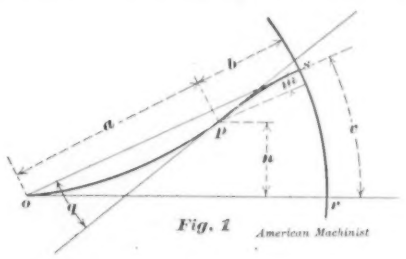


Fig. 1

Mr. Kerr has done in your issue of February 28th. It is true that this angle is very small, but the angle of deflection of the arm is also very small, and if we neglect such deflection we at once assume conditions which would make any bending strain impossible. Small quantities can only be neglected when they are small *compared with* other small quantities which form principal factors in the calculation. Mr. Kerr's conclusion that the bending strains at hub and rim are equal is therefore not correct.

Mr. Jones assumes that in the limit the bending strains at o and s are proportional to the angles between normals to the section of arm and line of displacement $o\,s$.

This is a false assumption, and Mr. Jones' result is therefore not correct.

If the arm is tapered toward the rim the point of inflection will be nearer the rim, and if we assume some deflection of the rim the point will move still further out. A tapered arm is evidently the right thing.

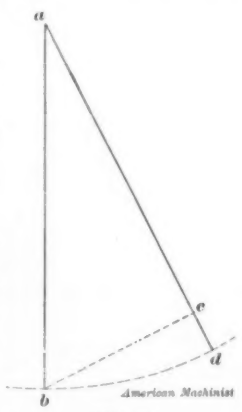


Fig. 2

By assuming a uniform taper to the arm and taking the hub in consideration a correct formula may be worked out for the strains, but it would involve some integration, and a good deal of algebra.

The correctness of my analysis cannot be disputed without questioning the theory upon which all calculations of transverse or indirect strains are based; but I do not expect that any of the parties in the controversy will admit this, for our results do not agree. Who will decide in this matter?

I think the arms are made heavy at the rim to insure a good casting, for it is generally considered better to have all adjoining parts of a casting of as nearly uniform section as practicable, so that one part shall not cool much earlier than the other. The designer will rather be sure to have the casting come out right than to take his chances and possibly lose part of the pattern. But is there any safety in heavy arms as far as the soundness of casting is concerned?

I have seen pulleys with very heavy arms cracked at the rim, presumably because the hub was too heavy, and in cooling drew the arms away from the rim, and I have seen pulleys with very light arms come out sound.

The effect of gravity on a body suspended by a string is directly as the sine of the angle of deviation from the plumb line, not as the versed sine, as Mr. Porter has it in your issue of February 28th.

Let a (Fig. 2) be the point of suspension, and let the body be moved to d. Then if the weight is represented by the line $a\ b$, $a\ b\ c$ will be the triangle of forces, and we have $b\ c$ representing the effect in the direction of motion; that is, the sine, or, for small deviations, the arc is directly proportional to the effect of gravity.

J. BEGTRUP.

The Proper Method of Projection.

Editor American Machinist:

Having read with pleasure the recent articles in your paper on projection of drawings, I beg to submit the following for the consideration of your readers, in defense of the method generally used in this section.

Assume a sheet of paper to be cut and folded into the form of a cube, and inclosing the object to be represented. On each face of this cube is drawn the view of the inclosed object that is presented to that face, as shown in Fig. 1.

Now, if the sheet be unfolded, the views will be found arranged in the order shown in Fig. 2, and as recommended by Mr. Hund.

It will be readily seen that a drawing projected in this manner has merely to be folded between any two views, to place the various parts of those views in their proper relative position, and to decide any question that may arise as to location.

GEO. A. FAIRBANKS.

City Engineer's Office, Watertown, N. Y.

Lectures on Electricity.

Prof. Francis B. Crocker, Professor of Electrical Engineering, School of Mines, Columbia College, New York, will commence the evening of March 21st, a series of six lectures on "How Electricity is Now Being Utilized." The lectures will be delivered on successive Thursday evenings, beginning with the date above named, in Room 11, Library Building, Columbia College. The special subjects to be considered are:

"How Electricity is Generated and Stored."

"Alternating Currents."

"How Electricity is Used for Lighting and Heating."

"The Electric Motor and Its Use in Transmission of Power."

"Electric Railways."

"The Telegraph and Telephone."

They will be illustrated both by drawings and working apparatus so far as possible. We are informed that Professor Crocker gives his services free in these lectures, and that the tickets, which are sold at $5 each, for the course, are intended to cover only the incidental expenses of the lectures, which are intended especially for engineers, lawyers and business men who feel the need of some knowledge of the recent progress in electricity.

Day's Work of the Average Workman.

According to Professor Thurston, a day's work, even for the average workman of full working power, varies greatly with the nature of the work and the method and facilities of its performance, and the same is true of the horse and other animals, but usually in less degree. The most powerful horses may be expected to develop, as an average, two-thirds of a horse-power for eight hours a day, 12,000,000 foot-pounds per day, very nearly, under favorable circumstances. The work of a man is variously given by different writers, but it is usually stated to be not far, at best, from 2,000,000 foot-pounds per day in the tread-mill, ascending mountains and stairways, when his own weight is the useful load, and carrying burdens on a level. Weisbach gives as maximum figures 1,935,360. Rankine gives 2,088,000, while Ruhlman states the work of a Prussian soldier, carrying a knapsack and other accoutrements weighing a total of 64 pounds, as about 3,000,000 foot-pounds. We may safely take 2,000,000 foot-pounds per day as a figure to be compared with the 10,000,000 foot-pounds of energy supplied,

Fig. 1

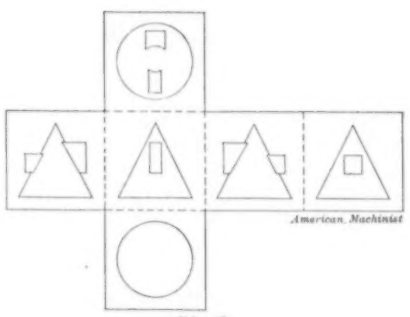


Fig. 2

PROPER METHOD OF PROJECTION.

and as giving a fair maximum for the efficiency of the animal considered as a prime motor. It is 0.125 horse-power for eight hours, 0.04 for the day.

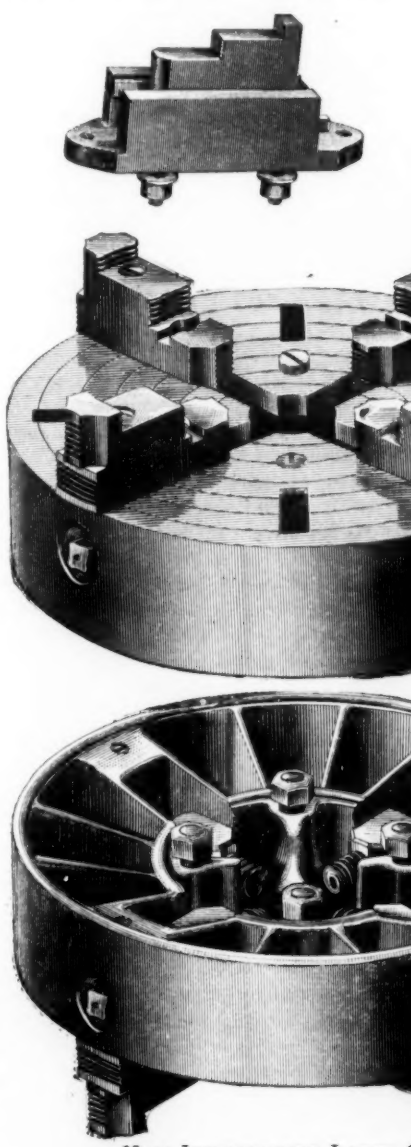
The Good Old Times in Iron Manufacture.

In discussing Mr. John Fritz's recent paper on the "Early Days of the Iron Manufacture," read at the Bridgeport meeting of the American Institute of Mining Engineers, Mr. E. C. Pechin said:

For many years Mr. Hughes Oliphant operated a small charcoal furnace and mill at what is now Fairchance, in Fayette County, Pa., at the foot of the Allegheny Mountains.

He told me that early in the century he ran for eighteen months, and in that time saw only $10 in money. I said to him: "How under heaven did you manage?" He replied: "We made our iron into nails, rods, and kettles, hauled them 12 miles over to Brownsville, on the Monongahela River, loaded them into flat boats, and floated them down the Ohio, swapping our wares for whiskey and rum. At New Orleans we exchanged these for sugar and molasses, which we sent by sea to Baltimore, and there we swapped again for groceries and dry goods, which we hauled in Conestoga wagons over the mountains, 300 miles, to our furnace."

In these days this would appear to be making iron under difficulties. It is a noteworthy fact that in those good times there was "free and unlimited" coinage of silver dollars.



NEW INDEPENDENT LATHE CHUCK.

New Independent Chuck—Face Plate Jaw.

The accompanying engravings illustrate a new independent chuck, especially designed for heavy work, and to stand rough usage. The main features are the same as the regular "national" independent chucks; the braces of the shell are increased in number, adding greatly to strength, without unduly increasing weight. The face of the shell is also thickened, and the depth of the chuck increased.

An important novelty is the dishing of these braces, enabling the chuck to be mounted close to the bearings of the lathe, thus giving the least possible overhang. The screw heads are also recessed, so that the workman can stop the chuck by the rim without injuring his hand. This chuck is fitted with the reversible jaw, which has been previously described.

The principal dimensions of the 12′ size are: Actual diameter of chuck, 12⅝″; actual swing of chuck, with jaws fully extended, 14¼″; depth of body at outside rim, 3½″; distance between seat and face of chuck, 2 5/16″; thickness of front of shell, 1⅜″; largest work it will take, 12⅝″; smallest work it will take, 5/16″.

It is now made in three sizes, 12″, 18″ 24″, the latter only to order, by William Whitlock, 39 Cortlandt street, New York City, and is styled "The Western National Independent." The new face-plate jaw is by the same manufacturer. This jaw carries the regular "national" solid jaw, and is made in 8′, 10′, and 12″ sizes, to take the place of the larger and more expensive chucks, where the character of the work will permit of their use.

Navy Yard Notes.

A large increase in the force of employes is expected in the Steam Engineering Department at the Brooklyn Yard; the cruiser "Chicago" being booked for a new set of engines

These changes in the propelling machinery will also affect the construction branches, as a considerable amount of tearing-out work will necessarily have to be done on the hull.

The "Lancaster" is having her ancient battery changed for a modern type, and after refitting will be used for training purposes.

The battleship "Maine" is under the shears, and the monitor "Puritan" is in dry dock.

It is said F. Allard, a blacksmith living at Levis, Canada, has discovered a method of hardening aluminum, by which it is given the resistance of steel, or nearly so, without altering its specific gravity materially. It is said that he has made cannons out of this hardened aluminum, which have stood severe tests successfully.

AMERICAN MACHINIST

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J. G. A. Meyer, } Associate Editors
Chas. M. Jones, } and Mechanical Engineers.

Special Announcements.

Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale.

Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.

We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.

We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.

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NEW YORK, MARCH 21, 1895.

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Some American Rascals.

We publish elsewhere in this issue a letter from one of our friends, who having been victimized by a rascal, is public spirited enough to take some trouble to warn his fellow-manufacturers, that they may profit by his experience.

It may be proper to add that there seems to be at present something of an epidemic of swindling, by methods which concern our readers and friends especially. The irrepressible Fink is again abroad with his lubricating mixture. He still has his numerous and bogus testimonials, he is still in a hurry to make a sale of his receipt, and catch a train, and in some recent instances he has heralded his appearance by a telegram, which he evidently thinks is impressive and helps to explain his haste. In two instances that we know of he recently got into establishments where there were men who remembered our exposure of him a number of years ago, and his reception in these establishments was, of course, not to his liking; his chagrin at this, combined with the effects of too liberal potations, having caused him to make a rather ungraceful exhibition of himself at the depot in an Ohio town, while waiting for the train he had been in such a tremendous hurry to catch. In establishments where there are readers of the American Machinist he is not successful, but other establishments must probably be victimized by Fink, in addition to the other burdens they impose upon themselves.

Another game of another swindler is to go to a shop and claim to be a "reporter" for the American Machinist. A man made this claim in a machine shop in New York City recently. At this writing his scheme, whatever it may have been, has not fully developed, and his special object in claiming to be an accredited "reporter" of this paper is unknown to us. We employ no "reporters," though, of course, it frequently occurs that mechanics visit shops for the purpose of making investigations for us, or with a view to preparing contributions for our columns, and this of itself should not excite suspicion; but where there is any reason to suspect anything wrong, the visitor, if unknown, should be easily able to give a satisfactory account of himself.

Cruisers Versus Armor Clads.

The naval actions in the far East have been made much of by the champions of the light cruisers, as tending to condemn heavily armored vessels—the sinking of what were popularly looked upon as invulnerable iron clads being hailed as proof positive that the regular line-of-battle ship is too unwieldy for the rush of a modern engagement.

It matters little, seemingly, to the friends of the "paper shell" that the Chinese were utterly incompetent—that instead of forming into proper shape to allow their batteries full play they huddled together like a flock of sheep, "each behind the other," while the methodical Japanese circled around and planted shot, shell and torpedoes without receiving any very great damage in return.

The fact that trained athletes have been floored in street melees is no reason why men should not cultivate their muscle for rough encounters, and on the same line of argument the torpedoing of a poorly handled armor clad is no proper grounds against fitting naval vessels for regular stand-up hard fighting.

Had the Chinese fleet been properly massed in the battle of the Yalu the fire of their heavy guns could have been concentrated upon any vessel of the enemy that sought to approach—in such a way that torpedoing would have been almost, if not entirely, out of the question.

About the only "lesson" that can be learned from the war is the one that, seemingly, has to be beaten into every generation by means of humiliating defeat, which is that men, and not materials, are the only safe dependence in an emergency.

The finest ships and the most effective guns, whether they be of light or heavy type, are absolutely useless unless there are skilled and energetic men to direct and carry out the operations.

The work of the Japanese has yet to be properly appreciated by the world at large.

But a generation removed from semi-barbarism, these pleasant-mannered people have fearlessly embarked upon an enterprise that the older civilized nations would have scoffed at as impossible of success, and without any of the fuss and feathers so characteristic of communities when fired by patriotism and the lust of conquest, have thrashed the Chinese dragon as seldom a nation has been thrashed before.

The Japanese have long been known as adepts in the lighter arts, but it has been a great surprise to all outside of the Island Empire that such inoffensive people could rise to the stern duties of military operations, and, taking the modern engines of destruction that have been so few years in their possession, change at one skillful stroke the current of the history of the East.

The Japanese have not yet reached that state in which the directing of armed forces in battle depends upon amateur constructors, chemists and astronomers, as is the case with many more advanced peoples.

The victorious army and navy in the East have been in the hands of men who used the weapons placed at their command to the best advantage.

Instead of officering their ships and land forces with scientists fresh from the observatory, laboratory or college—men in touch with the common-sense principles of handling disciplined bodies to the best advantage have been given full sway, and the results have been such that the self-styled ruling powers stand in fear and trembling lest the victorious islanders turn their arms against the Occident in the near future.

Instead of being carried away with success the Japanese are methodically strengthening their position at home by erecting great iron works and factories for the building of ships, guns and all appliances, both for war and peace. Railroads for military purposes as well as for advancing commercial interests are under way, and those already in operation are being improved.

At the present rate Japan will soon be able to supply herself with whatever is needed for her further advance in the arts and sciences, or for aggressive or defensive military operations.

The "Kearsarge."

Considerable pressure is being brought to bear upon the Navy Department to have one of the proposed new battleships called after the famous vessel whose bones now lie upon Roncadore reef. Those who are agitating the matter are doubtless actuated by patriotic motives, and believe that the hoped for action of the department will serve to keep alive the interest that attaches to the ill-fated conqueror of the "Alabama." But the best intentions, unless bolstered by a certain amount of hard common sense, are liable to lead to results diametrically opposite to those we fondly desire to bring about, and before our officials yield to the public clamor, the matter should be carefully considered, both from a practical and a sentimental standpoint. There have been several vessels in our navy that carried the appellatives of others gone before, and in every instance they have been looked upon as standing nuisances, conducive to innumerable petty annoyances. The reason for this is that all references, official communications, orders, plans and specifications, appropriations for repairs, etc., etc., must have a qualifying adjective or a distinguishing numeral carefully attached, as otherwise the question will at once arise as to whether the original or the later vessel is meant. A name is intended as a distinguishing characteristic, and as such should not require either prefix or appendage, and whereas the mention of the old man-o'-war now brings up a mental picture of the events in which she won renown, "New Kearsarge" or "Kearsarge No. 2" would simply call forth profanity from healthy-minded men, at the stupid want of appreciation of effects of those who might be responsible for the sacrilege.

The "Kearsarge" is gone, lost through scientific seamanship, combined with a fine sense of personal responsibility on the part of her commanding officers. Let her rest with the halo of romance, undimmed by rejuvenation into modern form.

A Revolutionary soldier, armed with a Gatling gun and Borchardt repeating pistol, or Achilles in twentieth century cutaway using moral suasion upon a New York policeman, would scarcely be less calculated to revive the past heroics than would the attaching of the name of the old sloop of war to a mass of Harveyized armor, rapid-fire guns, and twin or triple propellers.

Death of Frederick E. Sickels.

A press dispatch from Kansas City, Mo., announces the death at that place on March 8th, of Frederick E. Sickels, the famous inventor of the Sickels cut-off valve mechanism for engines. Mr. Sickels died suddenly in his office, and at the time of his death was engineer of a Kansas City water company. He was born in Camden, N. J., seventy-six years ago, and though possessing very great ability as an inventor, died a poor man. His legal contest with Geo. H. Corliss, over the patents on cut-off mechanisms for steam valves, was one of the most notable trials of that nature ever held in this country, and resulted in a victory for Corliss only by a very narrow margin, there being many who believe that Sickels actually anticipated Corliss; and it is not at all improbable that if Sickels' patent had been properly drawn (as it ought to have been), he would have won the case. This is disputed, but is, nevertheless, the opinion of men conversant with such matters who have studied the history of the case.

Among the models which he exhibited at the exhibition of 1876 was one of an engine which he had compounded for some parties in Glasgow, Scotland. This engine was quite complicated as to its valve gear, but it operated with an economy which was considered wonderful at the time, and in explaining the model to a well-known engineer, Mr. Sickels said that Mr. John Elder and Mr. Napier, and some of the other famous marine engineers of Glasgow came to see it, and he said he "supposed they concluded that if a compound engine with all that stuff would work as well as my engine did, one a great deal simpler would work better, and so they all went to work building compound engines."

Mr. Sickels exhibited at Philadelphia the first steam steering engine ever made. This engine had two steam cylinders whose axes were at right angles, and their pistons were connected to a common crank, but the slide valves were not operated by the engine itself, as is usual, but were actuated by a hand wheel similar to an ordinary steering wheel, so that the engine could be stopped, started, and made to run in either direction, fast or slow, by turning this wheel by hand. For many years Mr. Sickels was associated with the late Edw. S. Dickerson, who won several suits for infringement of the Sickels' patent. The case of Dickerson & Sickels *vs.* The Bay State Steamboat Company was famous. The firm designed and built a very peculiar pumping engine for the city of Detroit about 1860, which was a total failure, more from imperfect proportions and faulty details than any other cause.

Mr. Sickels designed and erected the engines of the U. S. Frigate "Pensacola," and in the early days of the war he was suspected of not being in a hurry to finish the engines so that the ship could go into service, and to hasten his movements the authorities confined him to the engine room of the ship, and did not allow him to leave until the engines were tested.

The use of aluminum for torpedo boats is again talked of; Mr. Alfred E. Hunt, of the Pittsburgh Reduction Company, being especially interested in this, and having recently expressed himself as hopeful that it would be used in some of the recent U. S. Navy boats provided for.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(105) J. C. C., Dayton, Ohio, asks: Will a short stroke steam pump deliver as much water as one of long stroke, making the same piston speed? *A.*—Under a head of solid water on the suction side there would probably be no difference, but if the pump drew from a lower level the greater proportionate clearance of the short stroke machine would lower its relative efficiency.

(106) A. F. W., Whitinsville, Mass., writes: Please print a list of books which will prove helpful to young men learning the machinists' trade, and who have had no other than a common school education. Many of the books on mechanics are beyond young men who have had limited educational advantages. *A.*—In our issue of November 22, 1894, in answer to Question 539, you will find a course of study indicated and a list of books given which we believe are suitable for mechanics.

(107) E. B. L., Three Rivers, Mich., asks: What is producer gas? *A.*—It is the gas resulting from passing steam and air through a bed of incandescent coal. The coal is held in a receiver or gas producer fitted with suitable grate bars and other attachments which will maintain the proper incandescence of the fuel bed. The quality of this gas will depend on the quality of coal used and the conditions of manufacture. When air alone is passed through the incandescent fuel the resulting gas is termed "air gas."

(108) J. S., Philadelphia, Pa., writes: Please give a list of good books suitable for a young man who has worked about three years at the machinist trade; also state where these books can be obtained. *A.*—It is difficult to recommend books to persons without being acquainted with them, or knowing how much of an education they have had. You will find a course of study indicated in answer to Question 539 in our issue of November 22, 1894, with a list of books required; from these you can make your own selection.

(109) J. G. G., S. Lake Linden, Mich., writes: Please inform me what is a hydrokmeter, how is it constructed, and how is it attached? *A.*—It seems to us that you have not spelled the name correctly; we presume that you mean a hydrometer. The hydrometer is simply a floating body used in finding specific gravities. Its construction depends on the principle of flotation; it generally consists of some buoyant body, as hollow glass or copper weighted at the bottom and supporting a graduated stem, or one having a definite mark. There are two kinds, those of constant and of variable immersion. Those of constant immersion are made to sink in the tested liquid, whether dense or light, to the same depth by balancing with weights. Those of variable immersion have no movable weights, but rise or fall according to the density of the liquid.

(110) J. L., Utica, N. Y., writes: Please give me the address of parties who would let me have the patterns or would sell castings for a small vertical compound engine; high-pressure cylinder about 1¼ inches diameter, and low-pressure cylinder about 3 inches diameter. *A.*—You may obtain the castings from T. Shriver & Co., 333 East Fifty-sixth street, New York, or from A. L. Weed & Co., 106 Liberty street, New York. We do not know of any other parties who would be likely to furnish you with castings for so small an engine. We do not know whether the correspondent to which you refer has built an engine of the size mentioned. We cannot give you his address as all correspondence with us is considered to be confidential matter. Should you wish to communicate with him send your letter to us and we will take pleasure in forwarding it, and leave it to the option of the correspondent of making his identity known.

(111) R. G. A., Denver, Col., writes: Please give me a formula for a good pickling solution for sheet steel and castings. *A.*—For cleaning castings use 1 part of sulphuric acid to 10 parts of water. The vessel which holds this solution should be lined with sheet lead. The same solution is often used for steel, and may answer your purpose; we should advise you to try it before using it to any extent. Cast-iron should receive considerable attention after pickling, if it is intended to plate or japan them. The gray accumulation seen on the surface after this process will, if left thereon, be sure to fall off in time, bringing with it whatever has been subsequently applied. Simple water is not sufficient to accomplish a thorough cleaning from this objectionable film; the castings should be first steeped in a strong hot potash or soda bath, after which hot water or steam may be played over them until they are thoroughly clean, when after heat dried they are ready for the plating, japanning or paint. In rolling-mills, after pickling in the above solution, the bars are dipped in lime water and then dried.

(112) R. W., Columbus, Ohio, writes: Please inform me what are the properties of a gas generated from burning sand by molten iron, and its explosive power. *A.*—The molds and cores contain various proportions of organic and volatile matters, consisting of portions of roots, horse dung, coal, straw, etc., all of which when decomposed by the hot metal generate inflammable gases; in addition to which must be added steam from the moist sand, which, when decomposed, gives rise to hydrogen, while its oxygen combines with whatever carbon may be present in the material to form carbonic oxides. These inflammable gases when mixed with air produce a dangerously explosive compound. From the above it will be seen that the gases depend on the substances which enter into the mold, and little can be said of their explosive powers, but that they do explode with terrific force has been proven by sad experiences. It is in dealing with this objectionable compound that the molder's judgment and skill are frequently taxed to the utmost in order to avoid these terrible consequences.

(113) G. W., Waukesha, Wis., writes: I have read in your paper, during the past eight years, many articles on compound engines, and all mention some point of cut-off in the low-pressure cylinder. Why should there be any cut-off short of full stroke? With a tandem compound and a good surface condenser, the high-pressure cut-off being at half stroke, steam at 160 gauge, why not work the low-pressure full stroke instead of adding to back pressure by a cut-off? *A.*—Our correspondent has scarcely perused the articles he mentions with proper care. A cut-off on the low-pressure cylinder is necessary to prevent excessive drop at the high-pressure release. Unless the receiver is kept at such a pressure that the "low" takes steam at or near the terminal (expansion) pressure of the "high," there is a great loss of cord area. Where the high-pressure cylinder has been improperly designed and is too small to allow sufficient expansion of the necessary volume of steam to divide the power between cylinders properly, drop must be allowed to get the required cord area in the upper cylinder, but the loss of efficiency of the steam is in such cases excessive. See our issue of December 20, 1894.

(114) R. H., Jersey City, N. J., writes: I have an air compressor for light duty, the crank shaft of which is forged from a round piece of Norway scrap iron to $2\frac{5}{16}$ inches diameter, stroke of the compressor is 20 inches, that is, the length of crank is 10 inches. Please let me know what force in pounds on the crank pin, theoretically, will twist the arm of the shaft, and also give rule for computing the same. *A.*—The rule for finding this force is to multiply .196 by the ultimate shearing stress per square inch, and by the cube of the diameter in inches, and divide the product by the length of the crank in inches, the result will be the force on the crank pin; in symbols we have,

$$\frac{.196 \times s \times d^3}{l} = P$$

in which s = ultimate shearing stress per square inch, d = diameter of the shaft in inches, l = the length of crank in inches, and P the required force in pounds on the crank pin. Assuming a value of 50,000 pounds for s, we have,

$$\frac{.196 \times 50{,}000 \times (2\frac{5}{16})^3}{10} = 12{,}110 \text{ pounds.}$$

Of course, in the above it is assumed that the crank arm is strong enough for this load.

(115) R. R. E., Mt. Carmel, Ill., asks: What should be the size of steam ports for a 5 by 6-inch high-speed engine developing six horse-power? *A.*—You can make these ports 2 inches long and ⅝ inch wide. 2. How much lap should the slide valve have? *A.*—This is an indefinite question, as the lap depends on the cut-off and travel of valve. On general principles, with ports ⅝ inch wide, we should give the valve ⅝-inch lap; in this case, the travel of the valve should not be greater, or much greater, than twice the sum of the width of the steam port and lap. 3. What theory is advanced for aluminum that its specific gravity is so much less than that of other metals of equal bulk and weight? *A.*—No theory is advanced; the specific gravity of aluminum is based on the fact that aluminum is lighter than other metals. You evidently got mixed up on the meaning of the term "specific gravity," otherwise you would not have asked the question, for you might as well ask, why is wood lighter than iron? The specific gravity of a body is its relative weight; that is, it is the number of times the body is heavier than an equivalent volume of some other body, taken as a standard. The specific gravity of a body is obtained by dividing the weight of any volume of the body by that of an equivalent volume of the standard. For solids and liquids, distilled water is taken as a standard.

(116) C. V. A., Baltimore, Md., writes: In Nystrom's Pocket-book, edition of 1889, Example 1, a steam engine 54 inches by 96 inches, cut off at ½ stroke, 22 revolutions, 7 pounds water per pound coal, steam pressure 42 (absolute) the fire grate necessary is given as

$$\frac{54^2 \times 48 \times 22}{4.66 \times 7 \times 649} = 145.34 \text{ square feet.}$$

The 649 is the relative volume of steam to its water at that pressure, but in the steam table in the same book the volume for that pressure is given as 599.46. An older edition has 649 in the table. Can you tell me what the trouble is? *A.*—There is *always* more or less uncertainty as to the exact volume of steam from a given amount of water, as the possibilities of error in making experiments are very great. Nystrom's older tables were about as close as most others of the same date, but the refinements of modern methods were not possible with appliances then at hand. The later value 599.46 is nearer correct than 649. The formula quoted for area of fire grate cannot be relied upon, as no account is taken of initial condensation which in ordinary engines often amounts to 40 per cent. of the cut-off volume of cylinder.

(117) K. H., Evansville, Ind., asks: What is the proper angle to set propeller shafts, or, in other words, what should be the fall per foot in length? *A.*—The inclination of a propeller shaft is a matter of necessity and not a matter of choice. It is always desirable to place the propeller as much below the surface of the water as the design of the hull of the vessel will admit, but frequently the engine cannot be placed low enough to employ a horizontal shaft; hence the shaft must be placed in an inclined position. There are many steamers in which the propeller shaft has no inclination. 2. How many square inches are there in the projected area of a crank pin three inches in diameter and four inches long? *A.*—The projected area of any pin or journal is found by multiplying the length by the diameter of the pin or journal; hence the projected area of the crank pin referred to above will be $3 \times 4 = 12$ square inches. 3. Please give a sketch of a three-quarter stroke cut-off cam, such as are used on lever engines. I have seen two methods for drawing such a cam, but they do not give the same results. *A.*—The form of these cams depends much upon individual perception of the duty of the valve, and sometimes upon individual prejudice; it can, therefore, scarcely be expected that the form of the cam as determined by different designers will agree. We have no drawing of such a cam on hand at present. 4. What is a good paste for putting cloth on covered steam pipes, one that will not crack when heated? *A.*—The cloth for holding the covering on steam pipe is not pasted together, it is generally sewed together.

(118) A. R. A., Dundas, Canada, writes: Please inform me how to charge a horseshoe magnet so as to hold its strength. *A.*—The horseshoe magnet may be charged in several ways. One way is to place it in contact with the poles of a strong electro-magnet, and allow it to remain a few seconds under the influence of the magnetizing current; before removing the magnet the current should be broken. In electrical workshops a powerful electro-magnet is made as follows: A strip of very soft Swedish iron is taken, about 2 feet long, 3 inches wide and 1 inch thick. This is bent twice at right angles about 6 inches from either end so as to make a horseshoe shape. The ends may be planed flat. This horseshoe is then wound over from end to end with a half-a-dozen layers of No. 12 B. W. G. double cotton covered wire, and the whole mounted on a convenient wooden stand, the poles of the magnet pointing upwards. If through such a magnet 20 amperes of current is passed from a few secondary cells, a very powerful magnetism is excited in the iron core. Another way is to place each limb of the magnet in a coil suitable for the current to be employed. The following method may also be adopted: Place one pole of the magnet into a single coil in one direction, after a few seconds break the current and place the other pole into the coil from the opposite direction. In every case the current should be broken before the magnet is removed from the influence of the magnetizing current. 2. What brand of steel should be used for the magnet? *A.*—German spring steel is recommended; tool steel hardened and drawn to a straw color also answers the purpose.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 232.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Patents, H. F. Parker, Att'y, 26 Cort'ndt St., N.Y.

Cam-Milling. Machine Tool Works, Newark, N.J.

Marine Iron Works, Chicago (new catalog).

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 157 William St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Engine Castings, 1 to 6 Horse-power Vertical. The Humphrey Foundry, Bellefontaine, Ohio.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

American packing rings are in touch with the cylinder. New circular about rings and pistons. J. H. Dunbar, Youngstown, O.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Radial Drills for every possible duty from the Smallest to the largest, built by C. H. Baush & Sons, Holyoke, Mass.

Emery, emery wheels, grinding machines and grinders' supplies, quick process and large stock. When in a hurry, buy of The Tanite Co., New York City, Cincinnati, Ohio, and Stroudsburg, Pa.

New Jersey Art Metal Co., Passaic, N. J., finest thin and ornamental castings in brass, bronze, aluminum, etc.; machinery name plates in brass and aluminum.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 post paid. Published by John Wiley & Sons, 53 East Tenth street, New York.

"Modern Locomotive Construction." By J. G. A. Meyer. In this book the design and construction of all details of the locomotive and tender are considered from a practical standpoint. It contains illustrations of details made from working drawings, accompanied by plain directions for designing, and rules and tables for construction. Adapted to office and shop use. Price, $10. Published by John Wiley & Sons, 53 East Tenth street, New York.

An American Imitator of the Antwerp Swindlers.

CLEVELAND, OHIO, March 9th, 1895.

Editor American Machinist:

We have been very much interested in reading from time to time your articles on the swindlers of Antwerp, who have been swindling American manufacturers by ordering goods for which they never intended to pay.

This scheme is now being duplicated in this country. There is a gang of swindlers located in Baltimore and Philadelphia who are following exactly the same tactics. They have a nice looking letter head which is well calculated to deceive the uninformed. We have recently had a little experience with this firm which is known as R. D. Uhthoff, No. 106 Hanover street, Baltimore. This man buys goods in large quantities, but has no store, only an office. He sells the goods immediately upon their receipt at any price which he can get for cash. We know of one instance where he bought $1,500 worth of harness and sold same at the depot for $400 cash. In another instance he bought a piano at $1,000 and sold it for $300. Anything that he can buy or sell is included in his list of wares.

He recently bought a lot of bicycles and sold them for ten cents on the dollar. He has several men assisting him, but we have not yet learned all the names under which he operates, but we know that Martin H. Schleigh is one of them. When legal proceedings are threatened against them they laugh at you, and say they haven't anything excepting the clothes on their back. We know that this fellow Uhthoff has been jailed once or twice by parties whom he has swindled, but he keeps right on, as there seem

to be so many willing to send goods on credit. We think that in common justice the manufacturers of this country ought to expose such fellows.

We know that a great many people would feel bashful about admitting that they had been swindled, but we take the ground that if the man who is swindled would show up the swindlers that this kind of thing would be stopped, but these swindlers know that no one likes to be laughed at for being taken in, so they go on reaping a rich harvest.

You can publish this letter without any fear of the consequences, as we have the proof positive of their rascality.

Cleveland Twist Drill Co.

By J. D. Cox, Jr.

We have received from the secretary of the National Association of Manufacturers a pamphlet giving a detailed report of all that took place during the convention of manufacturers held in Cincinnati January 22d, 23d and 24th. In addition to a full report of all the addresses delivered before the convention, it contains the names of all the committees, and of the vice-presidents for the various States, together with the register of all who attended the convention as delegates. It will, of course, be found of interest to manufacturers, and can be obtained of the secretary, E. P. Wilson, Cincinnati, Ohio. It is standard size, 6″x9″.

Engine Cylinder and Bed Finishing—Methods and Tools—I.

1. At the Rhode Island Locomotive Works.

"I believe," said the superintendent of the Rhode Island Locomotive Works to me, "there can be no possible objection to giving you the information you desire for publication. We don't claim to excel all the world, and we are not ashamed to say what our practice is." I made a remark to which the superintendent replied, with a laugh, "Nobody need be afraid of the fellow who has to have somebody else to tell him what to do. Go wherever you wish in the works." "No, you do not need any authority if you are once inside, take whatever photographs you wish, and come to me for whatever you wish to ask about."

Fig. 1.

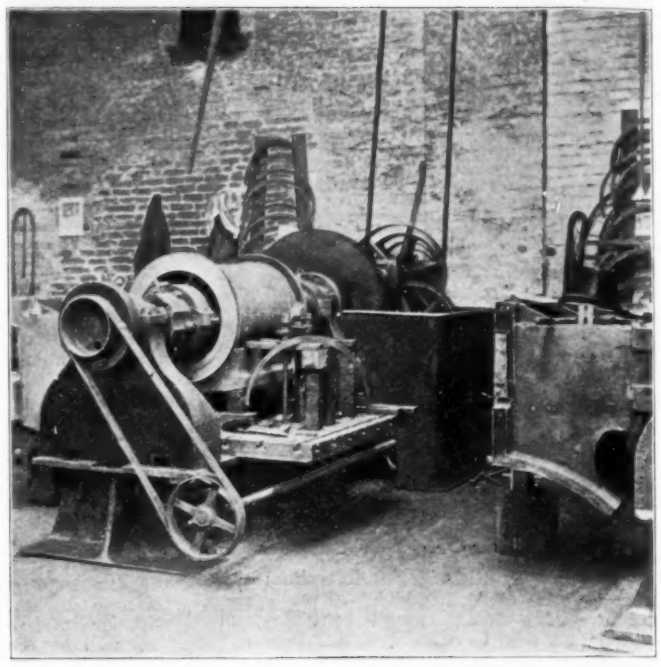

Fig. 2.

Fig. 3.

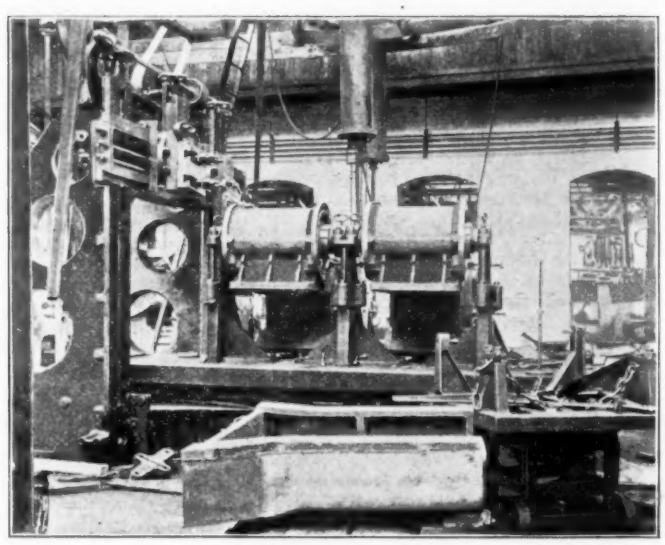

Fig. 4.

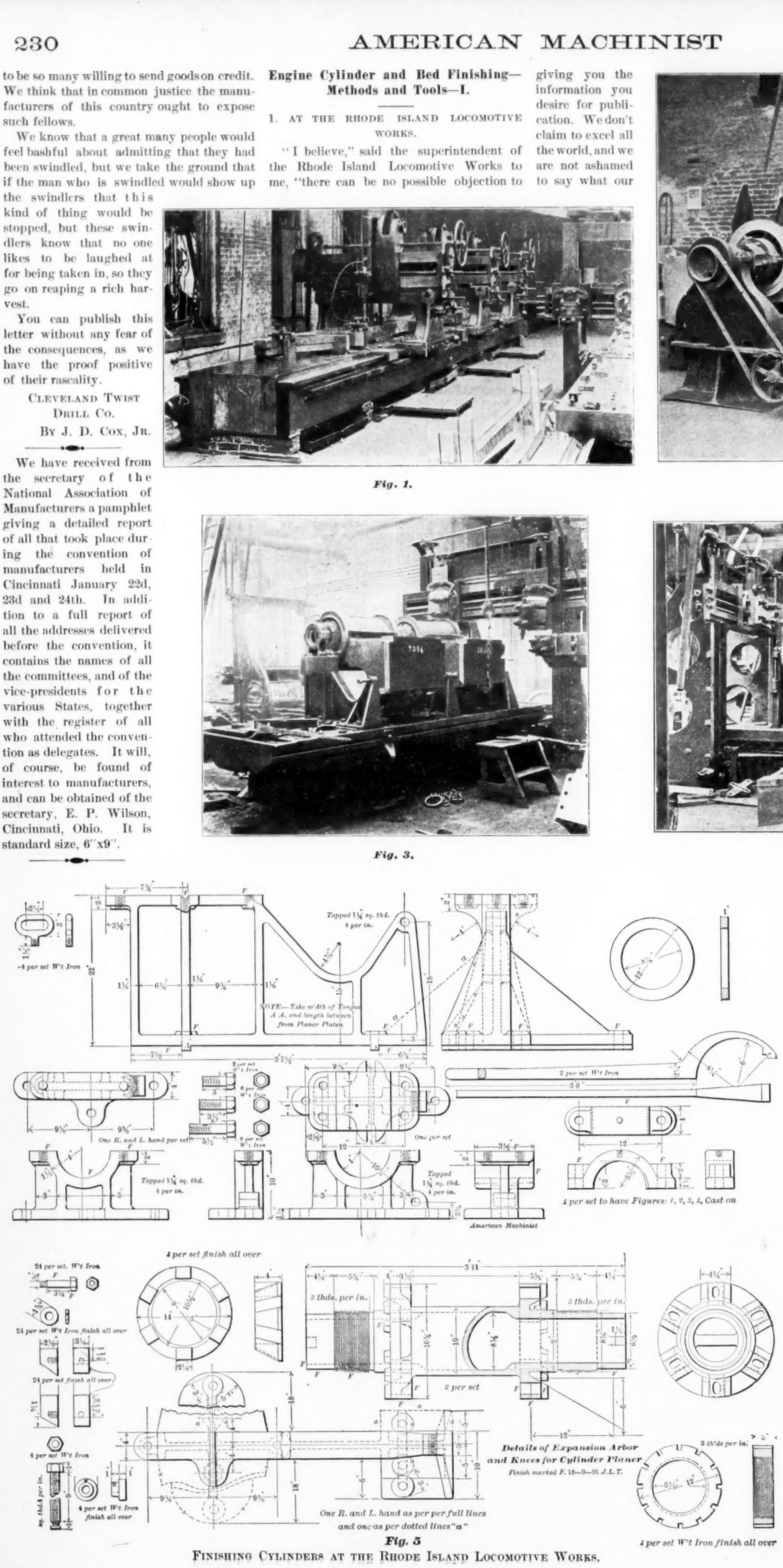
Tapped 1¼ sq. thd. 4 per in.
NOTE.—Take width of Tongue A A, and length between from Planer Platen
4 per set W't Iron
2 per set W't Iron
6 per set W't Iron
8 per set W't Iron
One R. and L. hand per set
One per set
Tapped 1¼ sq. thd. 4 per in.
4 per set to have Figures: 1, 2, 3, 4, Cast on
American Machinist
4 per set finish all over
24 per set. W't Iron
24 per set W't Iron finish all over
24 per set finish all over
4 per set W't Iron
4 per set W't Iron finish all over
3 thds. per in.
2 per set
Details of Expansion Arbor and Knees for Cylinder Planer
Finish marked F. 18—9—91 J. L. T.
One R. and L. hand as per per full lines and one as per dotted lines "a"
4 per set W't Iron finish all over

Fig. 5

Finishing Cylinders at the Rhode Island Locomotive Works.

The works were quite busy with an order for 25 heavy engines for the Consolidated, and the tools I wished to see were all in operation. Fig. 1 shows the first of them, a frame-slotting machine, with three traveling heads, by Fairbairn, Kennedy & Naylor, Leeds, England. This tool was bought in 1881 at a time (unlike the present, unfortunately) when our own American tool-builders could not fill the orders which were tendered them. This machine has had many minor improvements added by the Rhode Island Locomotive Works, and is now a solid efficient tool and fairly good in the handling details, which were its weak points when it left home.

The stationary table is 38 feet long, and the traveling heads are 46 inches between and 19 inches under in the clear, and the rams have 12 inches extreme stroke. All three heads are, of course, entirely independent in all their actions, and the tool requires three hands to attend it. It cost at the Rhode Island Works $6,500. The frames have their flat sides planed on an ordinary planer, and are then clamped in pairs and have their outlines finished to drawing on the traveling head slotter.

These three traveling heads have adjustably revolving tool holders fitted at the lower end of the vertically moving rams, and these revolving tool holders have water holes in the middle lengthwise, and are fitted with a hose on top so as to give a running stream of water on the tool all the time. The re-

volving tool holder carries a worm gear at the top to which is fitted a worm journaled in lugs solid on the end of the ram, and the sliding head carries the ram, the ways in which the ram travels up and down, and the ram driving crank and gear which take motion from the splined shaft seen above the main cross-slide, and fitted with a fly wheel outside. A single crank wrist adjustable in the large gear (seen in front just below the splined shaft) drives the cross-feed screw with the usual ratchet and pawl, and this pawl arm has a chain fastened at one end and the chain is led around a sprocket ratchet and pawl wheel, and then up over an idle sprocket, and the down-hanging end of the chain carries a heavy ball which gives the motion one way to the sprocket ratchet and pawl on the lengthwise feed shaft, all shown in Fig. 1. The Rhode Island Locomotive Works have a smaller Bement two-traveling head slotter, 25 years old, and an excellent tool to-day, with a very different feed. These details are described, as the traveling head slotter is little used outside of locomotive shops, and may be strange to some readers.

All the processes of cylinder finishing are carried on in one room, equipped with three boring machines, two planers without special features, one Bement & Miles 72-inch by 72-inch by 180-inch planer, which is fitted with the planing fixture shown and described generally and in detail, a valve seat planing machine in the form of a large shaper, also by Bement & Miles, and a port finishing machine. Overhead this room is fitted with air-hoist tracks on which travel cylinders capable of handling any piece which comes into the room with a promptness and ease surprising to one not familiar with the use of this device.

The three cylinder boring machines, shown in Fig. 2, are remarkably compact, handy and simple. As stated, they were built by the Rhode Island Locomotive Works; the first one was built in 1866, and the others have been added from the same patterns. They are not only extremely simple, but extremely creditable to the to me unknown designer. They consist of a plain box bed, with a top flat except for the middle groove which lines up the movable tail stock and the two similar fixed head-stock uprights; these three pieces are nearly alike and are all tongued to fit the bed groove, as is the flat cross T-grooved table, bolted to the top of the bed on which the cylinders are clamped. The boring bar is supported in journals in the head and foot blocks, strongly driven by a vertical belt and double back gear, four speeds; the feed shaft seen in front and underneath the table runs even turns with the boring bar, and the difference in diameters of pulleys on the screw and on the feed rod defines the rate and direction of the travel of the sliding boring head on the boring bar. The boring bar is at all times supported in the two head-stock journals; the foot block is so bolted to the bed as to be quickly loosened, and is provided with an eye bolt on top to take an air-hoist hook and be readily lifted and swung out of the way when taking out or putting in a cylinder. The boring bar takes a sliding head star-feed facing tool arm at either end as desired. Two very bright handy lads were operating these three cylinder boring machines, and the work they were turning out was entirely satisfactory from every point of view. The engraving shows the racks of solid calipers for gauging the cylinders, and one caliper is hanging on the clamp at the right of the cylinder, and an air-hoist hook is seen on the left with a bell-shaped air-cock handle hanging just beyond it. I have seen much more expensive boring machines (these cost about $2,000 each), but I never saw anything more worthy of being called an up and down good every-day tool.

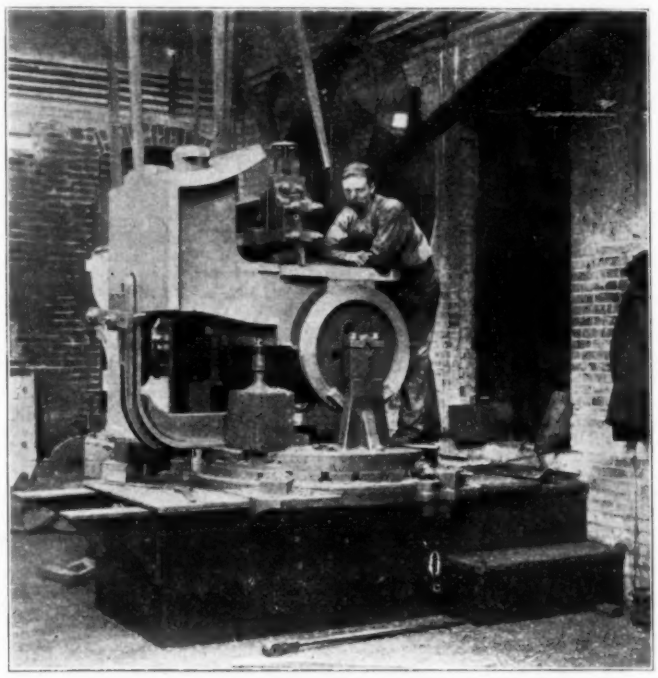

Fig. 6.

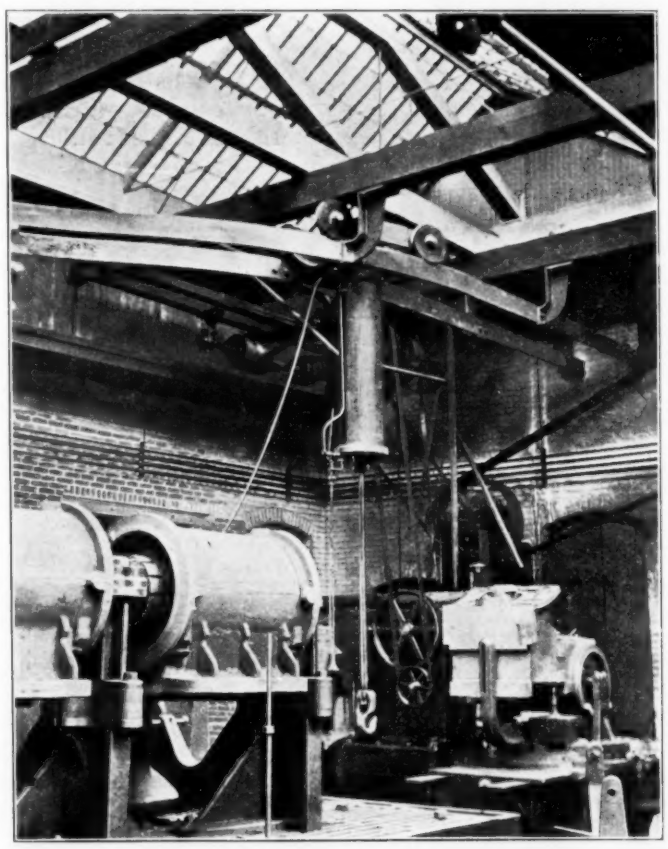

Fig. 8.

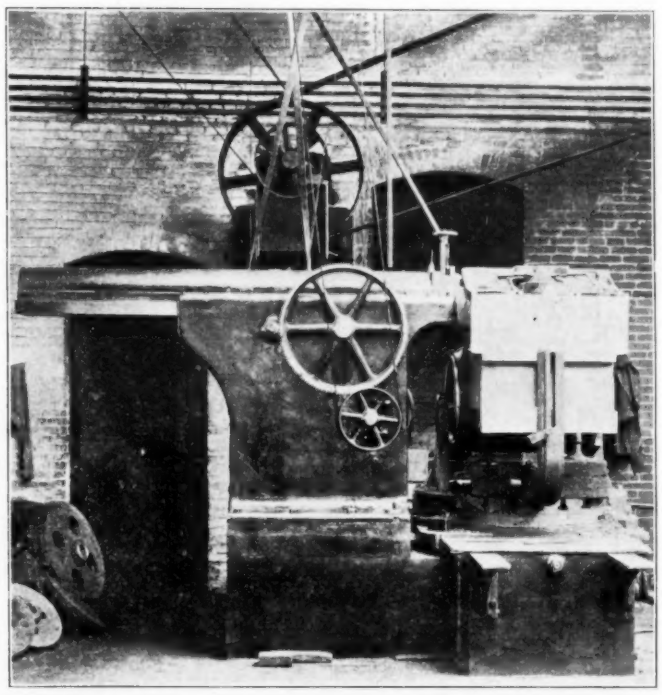

Fig. 7.

FINISHING CYLINDERS AT THE RHODE ISLAND LOCOMOTIVE WORKS.

Figs. 3 and 4 show two views of the planer fixture for planing the cylinders in pairs. Essentially, the method is, take a pair of cylinders after boring and put the two cylinders on one expanding arbor with the front end of one cylinder next to the rear end of the other, mount this bar in three journals of adjustable hights, and then plane both cylinders by the same cuts, except for the valve faces. This brings the cylinders so they are right and left, and yet exactly like each other as to center distance of cuts and as to angles. As will be seen from Fig. 3 (the side view of the planing fixture), the arbor is journaled at the middle and each end, the different hights needed being obtained by introducing longer or shorter distance blocks between the flanged sole pieces bolted to the top of the planer table, and the capped arbor pedestals, six through bolts serving to hold the whole nine pieces (three pedestals, three distance blocks and three sole pieces) together. The sole pieces have ribbed extensions to the right (in the front view, Fig. 3), which carry horizontal clamp screws, and the pedestals also have clamp screws, so that the cylinders can be perfectly supported against the cut of the tools. The three arbor supports and journals are independent, and so can be set any distance apart to suit any length of cylinders, without waste of planer travel, and the caps have air-hoist eye bolts, of course, for easy handling. The planer is fitted with two saddles on the cross rail, and one on the front upright for vertical cuts.

As will be seen, once given the pair-on-the-arbor idea the expanding arbor to accurately center all sizes of cylinders is about the only point left for consideration; this point is very neatly satisfied by nut-forced jaws sliding in radial slots with angular bottoms in heads on the bar, all very clearly shown in the expanding arbor scale details given in Fig. 5 from the original construction sheet. It is all very simple and convenient. This method was devised, and the planing fixture built in 1892. A slender steel crutch seen in front on the planer table in Fig. 3, has an adjustably secured sliding extension, which may be set to measurement from the inside of the crutch, and then the crutch applied to the surface of the planing arbor, and the free end swung to any angle to get accurate tool-edge distances from the cylinder centers. In the engravings the air hoists will be seen, so located as to handle the cylinders with great ease and convenience, so that even to lift the cylinder a trifle in shimming up for the setting, instead of using the little pinch bar always found on a heavy planer, the air is hooked on to make an eighth of an inch opening under the flange. Unfortunately I am unable to give the cost of this planer arbor and the three supports; I should say at a guess that $400 ought to cover it, including patterns and drawings, or perhaps even less; no matter what the price, it was a good investment.

Figs. 6 and 7 show the shaper for planing valve and steam chest seats by Bement & Miles, purchased 1889, cost $3,000. The ram has a stroke of 43 inches extreme, and a front extension of the sole plate is fitted with a revolving fixture base, T-grooved to take an adjustable angle arm, and carrying on its top surface two V-grooved uprights with seats for extension V-pedestals, all very clearly shown in Fig. 6. These extension pedestals are used to keep the valve faces always close up to the under side of the ram, so as to use a short shaping tool no matter what the cylinder diameter may be. The cylinders are supported on arbors having loose disks to fit the counterbore at each end. The valve face and two sides of the steam chest seat are planed at the first setting, Fig. 6, the previously planed side face being held vertical by the adjustable angle piece, and then, without moving anything, except its clamp bolts, the table is revolved 90 degrees to plane the other two cuts of the steam chest seat.

The air plant of the Rhode Island Locomotive Works has 80 pounds pressure, furnished by a South Norwalk $1,200 (10 inches by 14 inches steam cylinder) air compressor. Air hoists are used in the foundry, boiler, and machine shop, meeting with special favor from the molders for lifting off copes, an operation for which the soft, smooth action of the air piston, working without the slightest jar, is specially fit.

The constant use of the air hoists in the cylinder room recalled my own years of shop life as a planer hand on heavy work, with nothing but a pile of wooden blocks and an iron bar to lift the old-style box engine beds off the floor up onto the planer table with. We had no chain hoists in those days even, let alone air hoists which lift anything by a simple thumb-and-finger twist of a little air cock, and yet we thought we were well fixed because we had as good as there was anywhere, to our knowledge.

The Rhode Island Locomotive Works made their own air-hoist rigs, as they thought that course the cheapest, and they are of all diameters, from the one-wheel trolley lift, with its cylinder made of a piece of 4-inch drawn brass tube, at a total cost of less than $50, up to the three-ton lifts in the cylinder room. These large hoists are partly shown in several of the figures herewith, and Fig. 8 gives a complete view of one, including its four-wheel ball-bearing trolley, which makes it easy to push the hoist with its heaviest loads along the roof tracks; the one shown leads from the valve-face shaper

to the port finishing machine, and Fig. 8 also gives a good idea of the overhead track construction, the small air hose leading to the cylinder, little cock through which the lifting air is supplied, and the jointed down-hanging air-cock rods terminating in bell-shaped hand knobs to left of the long air piston rod with the heavy swivel hook at its lower end. These large air hoists cost complete about $250. The exact figures were not obtainable, nor could any reliable figures as to the total cost of the air plant be obtained. It must, however, be comparatively very small, as the compressor was only $1,200, and the piping is of small diameter and hence cheap. I fancy the total cost has been long ago repaid to the shop, so that the air hoist as it stands doesn't owe the works a cent. The large hoist shown in Fig. 8 has a 10-inch piston with 60 inches lift.

The labor in the cylinder shop is as follows: Two hands on the three boring machines, one on the big planer, one on the big shaper, and one on the two common planers in the cylinder room who does other work part of the time, and these five hands turn out three cylinders bored and planed per day, at an actual labor cost of, say, less than $5 each, including all handling, tool repairs and general supplies. Comment on this labor price is needless.

I desire to thank the superintendent of the Rhode Island Locomotive Works for his more than courteous readiness to give information, and also to acknowledge the kindness of the men who gave me every help to obtain the views of the work which I present.

Herman Landro.

An international exhibition of agricultural machinery will be held at Vienna, May 4th, 5th, 6th, and 7th, by the Imperial Agricultural Society of Vienna. Applications for space from America will remain open until April 15th, and machinery must be in place by April 30th. Communications should be addressed to the Committee of the Imperial Agricultural Society of Vienna, 13 Herrenstrasse, Vienna, Austria.

NEW CATALOGS.

We have received from the American Tube Works, Boston, Mass., a small catalog devoted to particulars regarding their seamless drawn brass pipe for plumbing.

William Sellers & Co., of Philadelphia, have issued a new catalog, which, though it is a trade catalog, is yet one of the most notable technical publications that has appeared for a long time. After looking through this volume the most distinct impression left upon the mind is that the work of this concern is, first of all, original. No one at all familiar with machine tools would make the mistake of attributing these designs to any other establishment, even if the pictures were seen without names or inscriptions of any kind. The variety of machines and tools illustrated is also very impressive, as showing the nature of the work that such an establishment is, in these days, called upon to do. Many machines, particularly those of a special character, are here made public for the first time, and no one interested in machine tools, or in machine design generally, can fail to be interested in them. The catalog is also, incidentally, an example of what can be done in the way of illustrating machinery by the half tone process, the engravings in this book being exclusively half-tone, improved, however, in every case by more or less hand work. The result is excellent, but the example is a dangerous one to follow without taking the utmost pains to secure good work. Another novel feature of the catalog is in the fact that the right-hand pages are devoted to general illustrations and short specifications of machines, so arranged as to be convenient for ready reference, while the left-hand pages are devoted to a more complete description and treatment of the principles followed in the designs. The book contains 429 pages, is bound in stiff covers (cloth), and is 7⅛ inches square, thus departing radically from "standard size"; but this book will naturally find its place upon library shelves rather than in catalog files; it is essentially an illustrated treatise, of great value, on machine tool construction.

MANUFACTURES.

A. Terry & Co.'s foundry, burned at Pequabuck, Conn., is to be rebuilt.

The Granger Foundry and Machine Co., Providence, R. I., has secured land, and will erect a plant shortly.

The Ellington (N. Y.) Town Board has appropriated money to construct an iron bridge over Clear Creek.

The Goulds Mfg. Co., of Seneca Falls, N. Y., is to put up a new building, and will want new machinery.

It is said that work on the new railroad from Broadalbin to Gloversville, N. Y., will be commenced next month.

The Bethlehem Iron Company, of Bethlehem, Pa., have resumed operations, and 1,500 workmen will be given employment.

The Stickney Iron Co., of Baltimore, Md., will build a new tinplate-mill to be operated in connection with its iron works.

It is said that an electric road will be built from Shelburne Falls to Coleraine, Mass. Richardson & Field, the Boston capitalists, are interested.

The State Railroad Commission in Albany, N. Y., have authorized the Batavia & Northern and the Oak Orchard Railroad Companies to construct roads.

H. A. Penrose has organized the Excelsior Keystone Mfg. Co., with a capital stock of $100,000, to build near Highlandtown, Md. A site 186 by 350 feet in size has been purchased.

The Palmer & Monson Street Railway Company has been organized to build an electric railroad from Monson to Palmer, Mass. The directors are Geo. M. Atkins, Geo. E. Buck, E. L. Bodfish, Rufus Flint, of Palmer, and Geo. C. Flynt, E. D. Cushman and R. M. Reynolds, of Monson.

Machinists' Supplies and Iron.

New York, March 16, 1895.

Iron—American Pig—We quote standard brands, $12 to $12.50 for No. 1; $11 to $12 for No. 2, and $10.50 to $11 for No 2 Plain. Southern brands, $11.25 to $11.50 for No. 1; $10.25 to $11 for No. 2; $10 to $10.50 for No. 3; $10.50 to $10.75 for No. 1 soft; $10.25 to $10.75 for No. 2 soft; and Foundry No. 4, $9.50 to $10.

Antimony—The market is quiet, business moderate. We quote L. X., 8¼c. to 8¾c.; Cookson's, 8¼c. to 8¾c.; Hallett's, 7½c. to 7.20c.; and U. S. French Star, 7¾c.

Lard Oil—Prime City we quote at 52c. to 53c.

Copper—The price of Lake Copper has declined a little, causing an increase of business. Second-hand Lake Copper has been sold at 9.45c. to 9.50c., and Casting Copper is held at 9c. to 9¼c.

Lead—The market is weaker in tone, although considerable selling has taken place between speculators. Sellers ask 3.07½c. for New York delivery without attracting buyers.

Spelter—The market is dull, and quotations are nominal at 3.20c. for New York delivery.

Tin—The market is unsettled, quotations range from 13.05c. to 13.30c. for prompt delivery.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Technical graduate wants position as draftsman. Address Box 118, care American Machinist.

Wanted—Agents traveling and local to sell steam spec's; good commission. Mfr., 1115 State St, Erie, Pa.

Mechanical draftsman, 4 years' prac. experience, tech. education, wants pos. Draftsman, Am. Mach.

Wanted—Foreman for machine shop, 40 men employed. Address C. W., American Machinist.

Foreman machinist, exp'd on medium and heavy work, desires to change. Box 135, Am. Machinist.

Position wanted by draftsman and designer; technical education; shop exp. Box 137, Am. Mach.

Wanted — First-class mechanical draftsman, American or English. Address Box 138, Am. Mach.

Mech. draftsman & engineer wants position; good refs.; N. Y. preferred. Box 139, Am. Machinist.

Agents wanted for a fast-selling boiler-room specialty. Essex Bros. Mfg. Co., Lorain, Ohio.

A young man who has a good business and mechanical training desires a position in an office or factory. Address Box 129, American Machinist.

Mechanical engineer and draftsman, tech. graduate, exp'd in designing pumping and hydraulic machinery, is open for engagem't. Box 132, Am. Mach.

Wanted—Position as foreman boiler maker; experienced in all kinds of boiler work. Address Box 136, American Machinist.

Wanted—A situation as draftsman; has had several years experience in marine and gen. engineering work. Address W. B., Am. Machinist.

Wanted—Pos. as foreman in machine shop; experienced, good references, age 32; New York State pref'd. Address "Nuker," Am. Machinist.

Foreman patternmaker who knows his business, and how to get work done, desires engagement, immediately. Box 140, American Machinist.

Draftsman (25) tech. education, 9 years machine shop and drawing office experience, desires pos.; engines or pumps. Box 141, American Machinist.

A first-class man wants position as foreman (or to lay out) in either boiler or gas-holder works; A1 refs. (.0 years' experience). Address Box 124, American Machinist.

(*Continued on Page 233.*)

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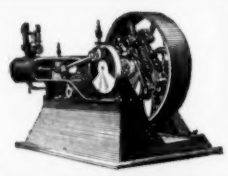

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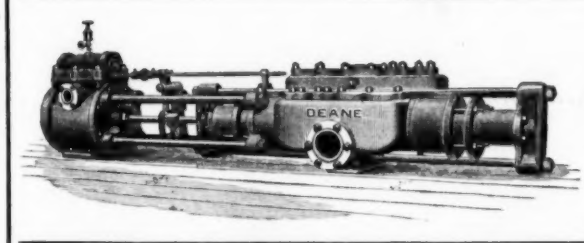

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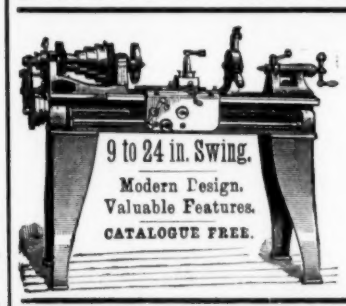

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A good machine shop, with new tools and young management, situated near Cincinnati, Ohio, wants to correspond with parties wanting machinery built. Middletown Machine Co., Middletown, Ohio.

Wanted—Two or three draftsmen: experienced in machine tools and general heavy machinery; give age, salary required and references. Address Farrel Foundry and Machine Co., Ansonia, Conn.

A pushing, practical foundry foreman with large experience in handling work and men, desires position; well up in mixing and melting metals, and general foundry knowledge; American, age 38, A1 refs. Address Engine Work, AM. MACH.

Inventors or manufacturers of typewriters, registers, etc., desiring the services as sup't of a practical toolmaker & draftsman exp'd in designing for econ'l manufacture, to design & sup'd the making of special tools & fixtures. Sup't, care AM. MACH.

Wanted—A competent gen. mach. to act as an instructor in a trade school. Applicant must speak German, and possess a fair education. Address in own handwriting, stating age, nationality, exp. & salary exp't'd, Supt., 225-227 East 9th St., New York.

Mechanical engineer, age 30, thoroughly versed in the theory, practice and design of steam and refrigerating mach'y, desires sit. as eng'r or designer, competent to assume complete charge and responsibility of any work in these branches; strictly highest class refs. A. M. B., AM. MACH.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

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For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—A purchaser for a good key-seater, by Mitts & Merrill, 913 Tilden Street, Saginaw, Mich.

Bicycle Repair Outfit. Send 6 cents postage for full illus. catalog. Frasse, 17 Warren St., New York.

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Wanted—To correspond with any one in need of a first-class key-seater. Address Mitts & Merrill, No. 913 Tilden Street, Saginaw, Mich.

Wanted—Complete Vol. 1 (1878) AMERICAN MACHINIST; also 1 copy each Jan. 1 & 8, 1881; must be in good condition state price. G. L. T., AM. MACH.

Partnership wanted in a paying established business by an experienced and successful mechanical engineer and manager who can invest in ready cash and devote his entire time to the business; no objection to joining with a good business man with corresponding capital in pushing a safe and profitable enterprise. Address with full particulars, Engineering Partner, AMERICAN MACHINIST.

Wanted—Second-hand machinery. Must be in good order. One Adt automatic wire straightening and cutting machine for No. 5 wire, 5 ft. lengths; one screw cutting engine lathe, 30 in. swing, about 12 ft. bed; one Hendey shaper, 24 in. stroke; one 2,000 lb. belt power freight elevator; 96 ft. 3 in. cold rolled shafting, 20 or 24 ft. lengths, with compression couplings; ten ball and socket 3 in. hangers, 24 in. drop. Address Lock Box 591, New Orleans, La.

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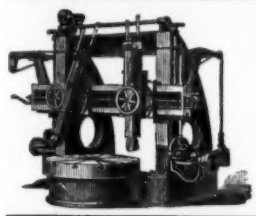

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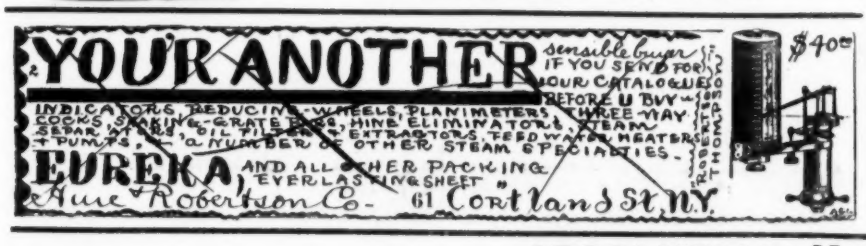
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Yours truly,
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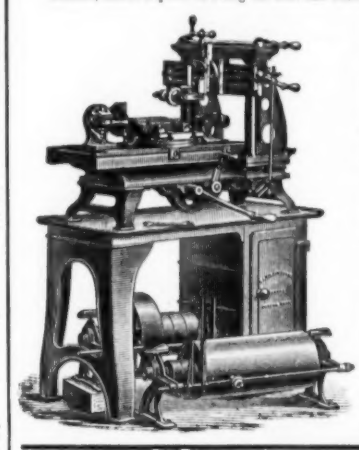

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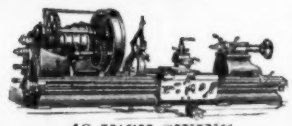

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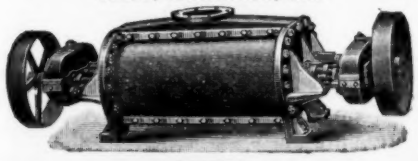

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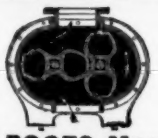

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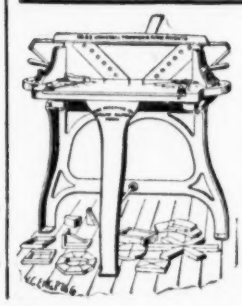

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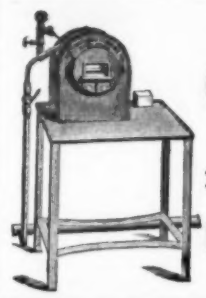

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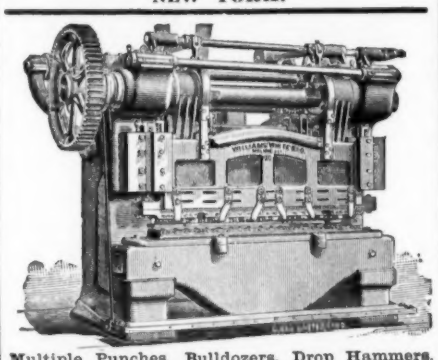

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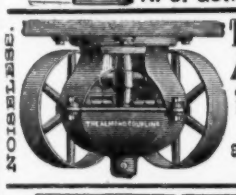

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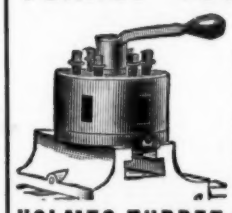

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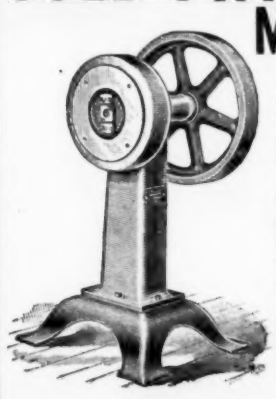

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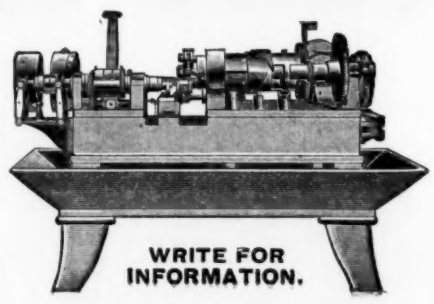

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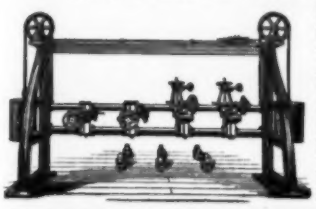

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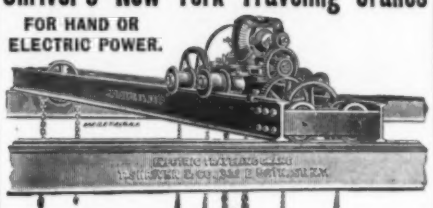

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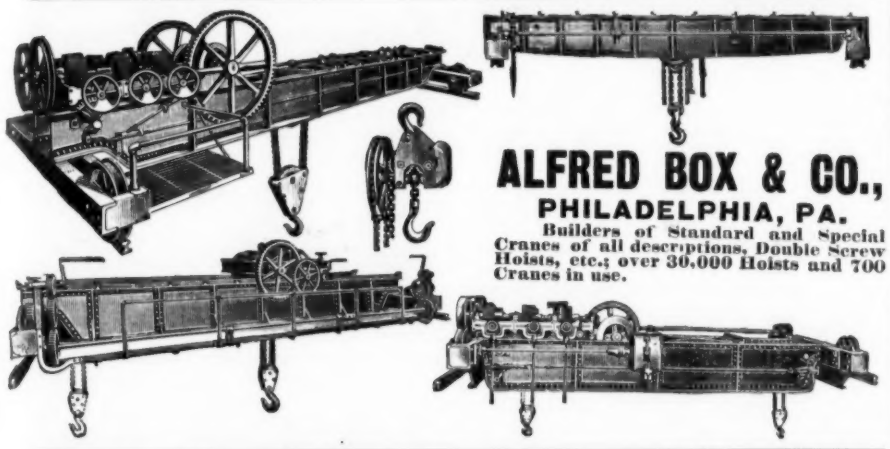

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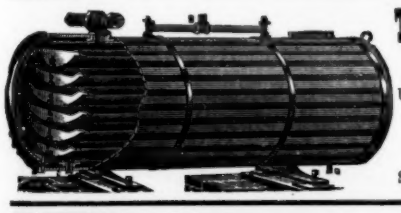

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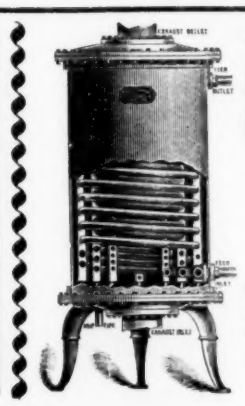

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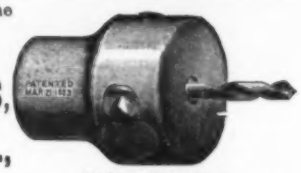

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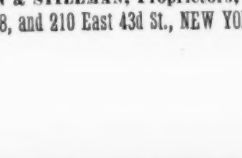

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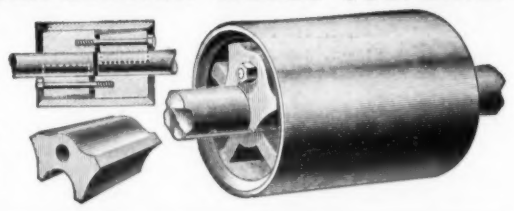

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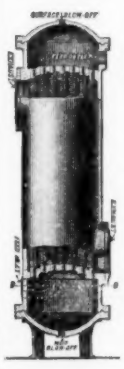

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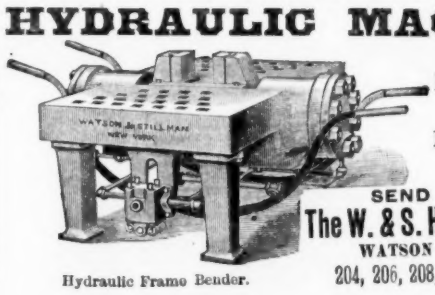

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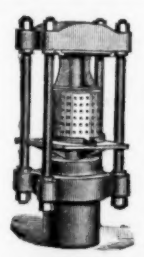

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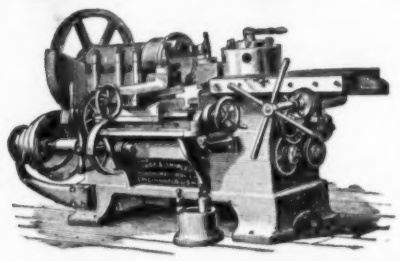

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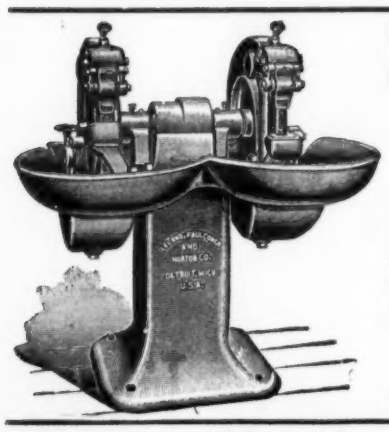

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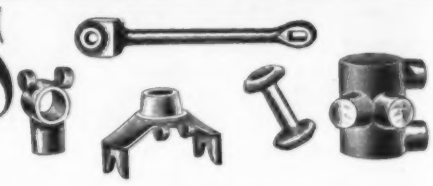

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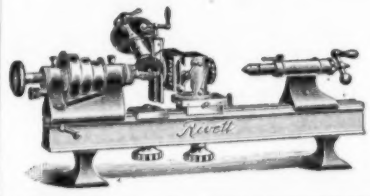

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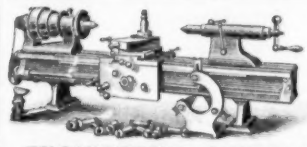

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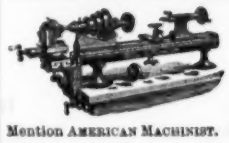

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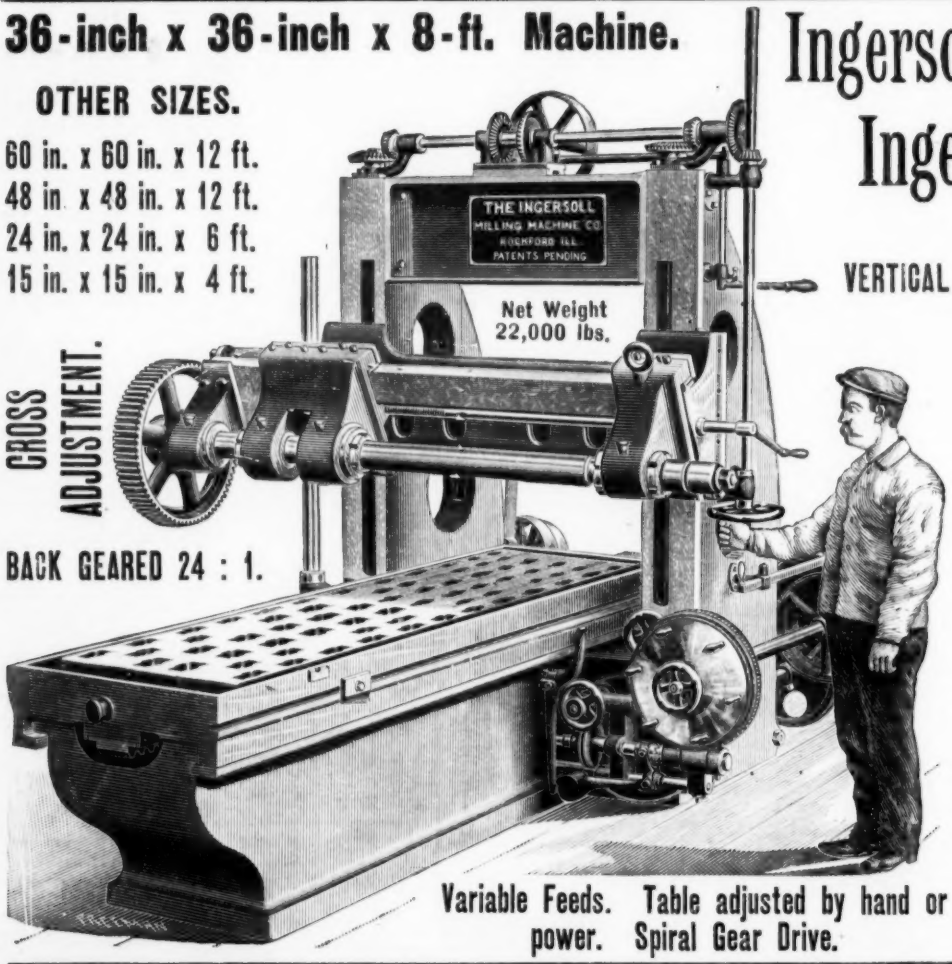

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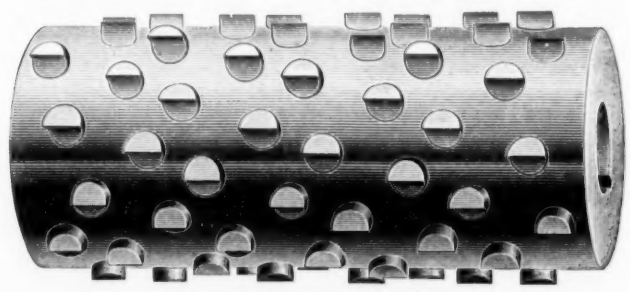

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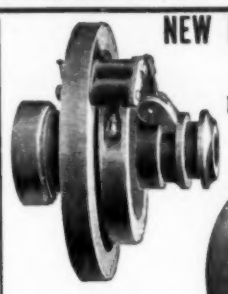

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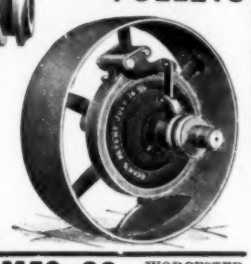

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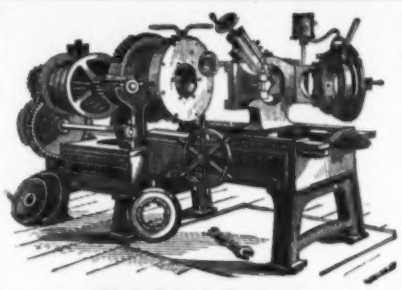

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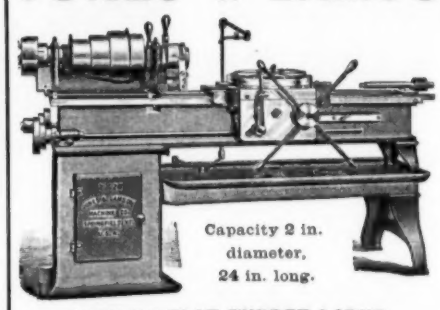

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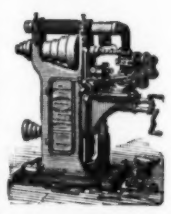

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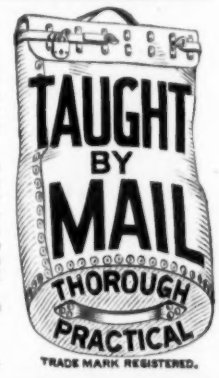

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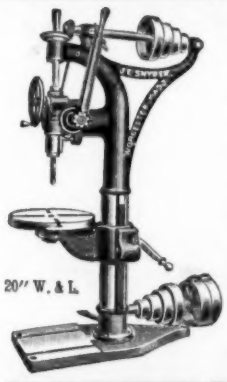

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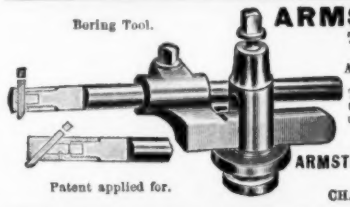

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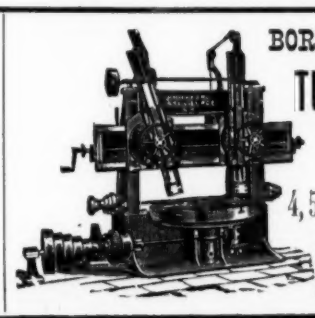

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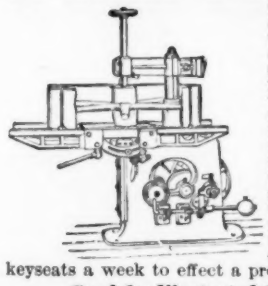

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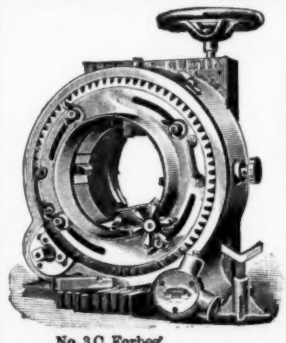

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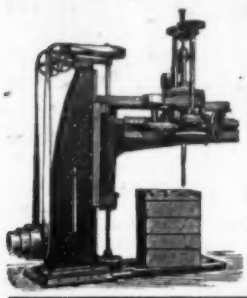

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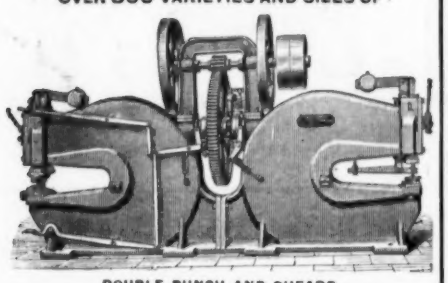

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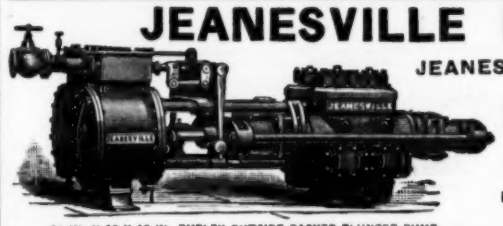

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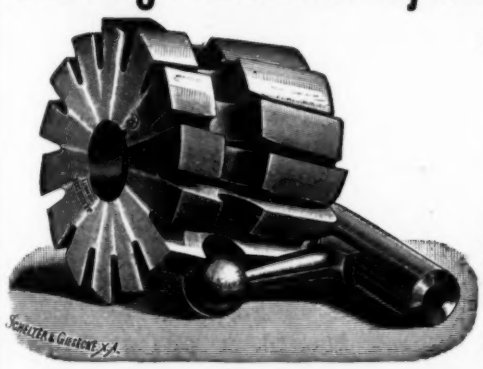

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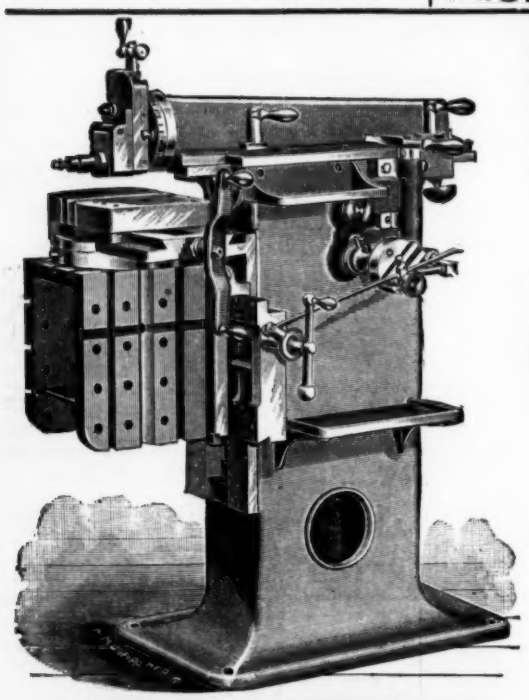

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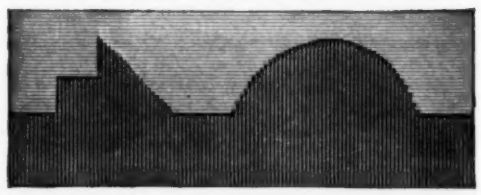

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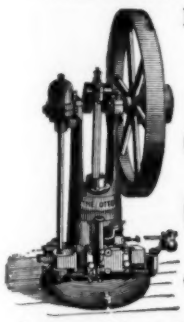

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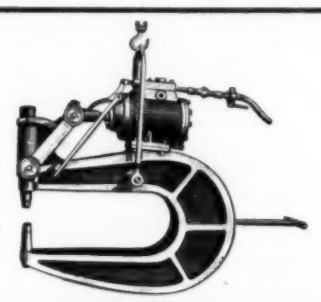

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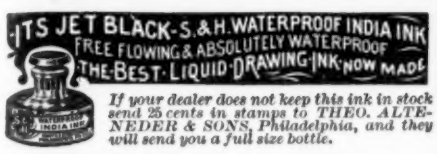

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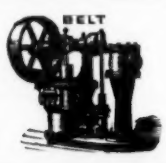

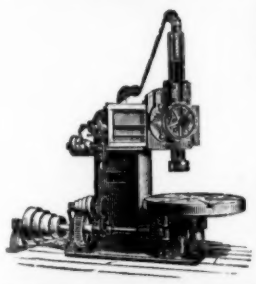

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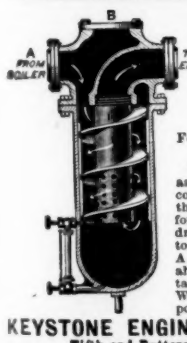

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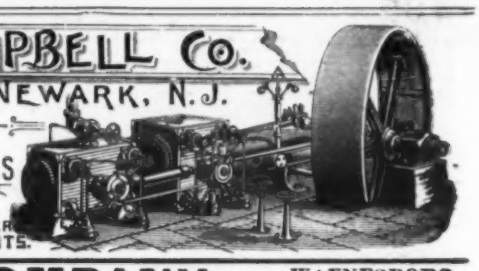

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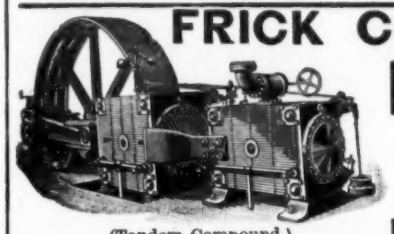

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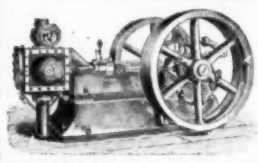

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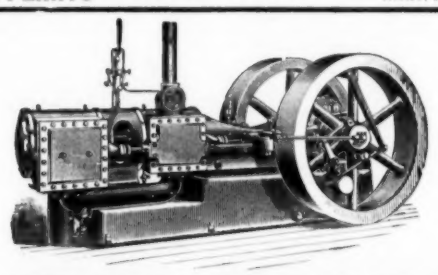

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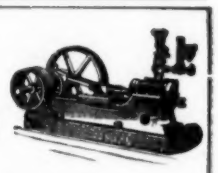

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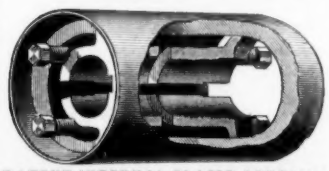

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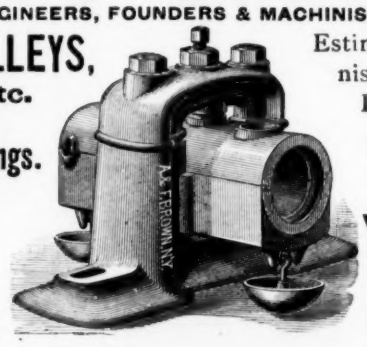

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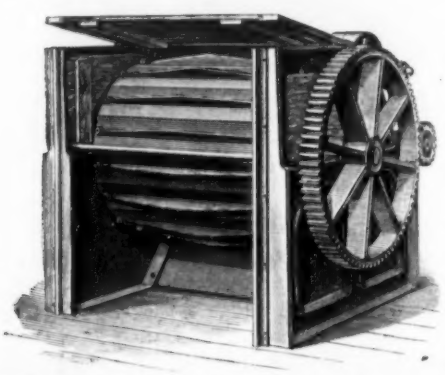

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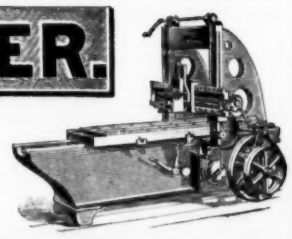

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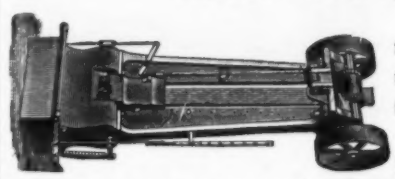

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